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STATURE AND WEIGHT OF CHILDREN OF THE UNITED STATES

WITH REFERENCE TO THE INFLUENCE OF RACIAL, REGIONAL, SOCIOECONOMIC AND SECULAR FACTORS

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Are children of the United States reared during the last twenty-five years taller and heavier than children reared during the quarter of a century immediately preceding? Is there an appreciable relation between the socioeconomic group to which children belong and their stature or weight? Does growth in stature and weight proceed at a different pace for children living in certain geographic areas than for those living in other localities? Do children of the United States of various racial or ethnic groups grow differently in stature or weight? It is common knowledge that attempts have been made to answer each of these questions. In fact, it is widely held that sufficient scientific information is already available to justify answering all four questions in the affirmative.

The purpose of this paper is to bring together representative results for investigations on the foregoing questions, to indicate certain limitations of the evidence and to suggest problems needing further consideration and study. Central emphasis will be placed on direct citation of research reports and multiple alinement of the results from one investigation with those from others.

The results of studies to date merit a concrete understanding and joint evaluation far beyond that which they have received. This becomes readily apparent if one considers a series of reasonably specific questions. For example:

1. Has it been dependably demonstrated that "there is something in the living conditions of California that serves as a stimulus to extra growth?" [1] Are there "growth stimuli" associated with other geographic regions which are sufficiently differential to necessitate the construction of special standards for stature and weight for various parts of the

From the State University of Iowa.

1. Lloyd-Jones, O.: California Tall Children, Am. J. Dis. Child. **60**:11-21 (July) 1940.

country? Should different standards be used in California and in New England? In the Northwest and in the Southeast? In rural Illinois and in urban Illinois?

2. Is it reliably established that "the average stature and weight of white children living in the United States and enrolled in public or private schools have increased during the last half-century"?[2] Has the average weight of 9 year old children increased by more or by less than 5 pounds (2.3 Kg.)? By more or by less than 10 per cent? What has been the approximate magnitude of the increase in average stature for 9 year old children? One half inch (1.3 cm.)? Two inches (5 cm.)? Four inches (10 cm.)? Over what age periods, if any, would it be justifiable to appraise the growth in stature and weight of children born during the decade from 1930 to 1940 in terms of standards published around 1900?

3. Are more pronounced differences in stature and weight associated with the cultural stratums in which children are reared or with the ethnic group of which they are members? Has it been shown that there are racial stocks represented in the United States whose growth in stature and weight is sufficiently diverse to necessitate construction of standards for specific ancestral or lineage groups? If so, do some racial divergencies become marked during infancy or early childhood and others not until the adolescent or early adult years? Is there crucial evidence available for either accepting or rejecting the hypothesis that children of the laboring classes should be judged by different standards for stature and weight than children of the professional classes? Are 14 year old children of the professional classes larger than children of the laboring classes by as much as 6 pounds (2.7 Kg.) in average weight or 2 inches (5 cm.) in average stature? Do differences in stature and weight associated with socioeconomic differences within ethnic groups commonly exceed those associated with differences between ethnic groups?

In the interest of brevity, several restrictions will be imposed on the ensuing discussion. All citations will be limited to two age levels (9 years and 14 years) and to one sex (male). Boys have been selected because more studies are available for them than for girls. It is intended that the ages 9 and 14 years shall be considered typical of the age interval extending from about 7 years into adolescence.[3] As a safeguard against employing values at either of these age levels which would not be representative, I regularly examined results for the adjacent ages.

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2. Meredith, H. V.: Stature and Weight of Private School Children in Two Successive Decades, Am. J. Phys. Anthropol. **28**:1-40, 1941.

3. The reader is cautioned not to overlook this delimitation. Neither the infancy and preschool years nor the years of late adolescence and adulthood lie within the scope of the present paper.

The differences between the averages for stature and weight which have been reported for various groups of boys of the United States of like ages cover a range of up to 6 inches (15 cm.) for stature and more than 15 pounds (6.8 Kg.) for weight. The published averages for stature at 9 years of age [4] vary from 47 to upward of 53 inches (119 to 135 cm.), and the averages for weight range from less than 52 to 68 pounds (23.6 to 30.8 Kg.). At the age of 14 years [4] the averages for stature lie along a continuum extending from below 58 to almost 64 inches (147 to 162 cm.), while the averages for weight fall between 87 and 110 pounds (39.5 and 49.9 Kg.).

How should these differences be interpreted? Do they necessarily imply that boys of the United States of elementary and high school ages have been found to be an average of 6 inches (15 cm.) taller if of Nordic ancestry rather than of Mongoloid lineage or an average of 15 pounds (6.8 Kg.) heavier if given optimum care rather than reared in a congested district and fed an inadequate diet? It is obvious that pending further delineation of the observations no more can be inferred than that unspecified environmental and genetic constellations have produced groups of boys of like age who differ to the extent of 6 inches in average stature and upward of 15 pounds in average weight. Each of the four sections which follow is focused on this question: What more specific inferences will the available researches support?

RELATION OF TIME TO AVERAGE STATURE AND WEIGHT

Taken together, the results of several comparative studies published over the past fifteen years [5] demonstrate that white children of elementary and high school age residing in the United States during the last quarter century have been taller and heavier than similar children of the previous quarter century. While adequate for indicating a trend in the direction of greater stature and weight, these studies have not been subjected to sufficiently broad intercomparison to yield dependable statements regarding the magnitude of the increases.

How much difference in average stature is there between comparable groups of white children living in the United States today and half a century ago? How much difference is there at 9 years of age? How much at 14 years? What constitutes a reasonable approximation to the difference in average weight at these two ages? Tables 1 and 2 both

4. Throughout this paper "9 years" and "14 years" each represen· exact, or midpoint, ages. Averages from studies using "last birthday" age groups have been subjected to interpolation. The method employed was that of graphing the averages as reported and then reading from the graph average values corresponding to 9 and 14 years of age.

5. (*a*) Gray, H.: Increase in Stature of American Boys in the Last Fifty Years, J. A. M. A. **88**:908 (March 19) 1927. (*b*) Lloyd-Jones.[1] Meredith,[2] pp. 22-25.

TABLE 1.—*Average Stature and Weight of Nine Year Old Boys in the United States of North European Ancestry and High Socioeconomic Status*

Stature, Inches	Weight, Pounds	Number of Subjects	Ancestry	Socioeconomic Status	Place	Time *	Investigator
53.5	69.5 †	77	North European ‡	Professional, managerial §	Cleveland	1931-1937 (1938)	Simmons and Todd [28a]
53.5	67.8	86	Northwest European	Professional, managerial ‖	Iowa City	1930-1937 (Unpublished)	Meredith
51.5	63.1 †	56	North European	Professional, managerial ¶	Medford, Mass.#	1925-1926 (Unpublished)	Meredith
50.0	56.7 †	313	Both parents American born	Professional, mercantile **	Washington, D. C.	(1898)	MacDonald [10]
49.5	58.1 †	137	Both parents American born	Professional, mercantile **	Boston	(1879)	Bowditch [9]

* Here and in subsequent tables, the figures in this column in parentheses refer to publication date of the study, and those not so enclosed give the year or years during which the data were being accumulated.
† Weight in indoor clothing.
‡ "With few exceptions...of North European ancestry."
§ Fathers engaged in "professional...executive...commercial and managerial occupations."
‖ Sixty-five per cent professional class and 35 per cent managerial.
¶ Twenty-five per cent belonged to occupational group I (professional) and 75 per cent to group II (semiprofessional and important managerial), Harvard Growth Study.[30]
# Seventy-seven per cent from Medford and remainder from Beverly and Revere, Mass.
** Styled by Bowditch and MacDonald the "nonlaboring" as differentiated from the "laboring" (skilled and unskilled) occupations.

TABLE 2.—*Average Stature and Weight of Nine Year Old Boys in the United States of Italian Ancestry and Low Socioeconomic Status*

Stature, Inches	Weight, Pounds	Number of Subjects	Ancestry	Socioeconomic Status	Place	Time	Investigator
50.8	59.5	55	"Italian"	Mean income approximately $1,100 *	Hibbing, Minn.†	1938-1939 (Unpublished)	Matheny and Meredith
49.4	58.6 ‡	75	"Italian"	Laborers, semiskilled §	Vicinity of Boston ‖	1925-1926 (Unpublished)	Meredith
47.9	56.9 ‡	115	"Italian"	From "congested district"	New York City	(1924)	Gebhart [11]
47.4 ¶	....	70	Southern Italian #	From "congested districts"	New York City **	1908-1910 (1911)	Boas [33]
46.8	51.8	e.20 ††	"Italian"	"Very poor" or "incorrigible"	New York Juvenile Asylum	(1899)	Hrdlicka [12]

* Boys from unskilled and semiskilled classes, such as sons of miners and W. P. A. workers.
† Communities within a radius of 50 miles (80.5 kilometers) of Hibbing, Minn.
‡ Weight in indoor clothing.
§ Occupational groups IV (semiskilled) and V (unskilled), Harvard Growth Study.
‖ Revere, Medford and Beverly, Mass.
¶ Stature taken "in schools in stocking feet; in families with shoes."
# Almost entirely of Sicilian or Neapolitan descent; every child American-born.
** "Chatham Square...upper east side...and...Yonkers."
†† In view of the paucity of subjects, the averages for children 8, 9 and 10 years of age were subjected to three point smoothing.

give averages for stature and weight [6] obtained from five samples of 9 year old boys. The samples in table 1 have been selected to represent boys of North European ancestry and high socioeconomic status. Table 2, on the other hand, has been compiled solely from data on boys of Italian ancestry and low socioeconomic status. For three of the samples included in each table the averages were available in published studies; for the other two samples of each table the averages were calculated by me. Both tables are largely self explanatory.[7] Both are characterized by a progressive increase in stature and weight with time.[8]

Table 1 shows that two samples of 9 year old boys examined between 1930 and 1937 (ethnic stocks, North European; occupational groups, professional and managerial; geographic location, Cleveland and Iowa City) had an average stature 4 inches (10 cm.), or 8 per cent, higher than a sampling of 9 year old boys examined before 1879 [9] (ethnic stocks, North European; occupational groups, professional and mercantile; geographic location, Boston). The average weight for the 1879 sample is about 11 pounds (5 Kg.), or 16 per cent, lower than the averages for the two samples obtained more than five decades later. Averages for the 1898 [10] sample are also lower than for the more recent studies. Table 2 registers extreme differences of 4 inches in average stature and 7½ pounds (3.4 Kg.) in average weight over a secular period of forty years. Here, geographic region ranges from Hibbing, Minn., to New York city,[11] social class falls within the semiskilled to indigent [12] zone and ancestry is traced through inhabitants of Italy.

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6. Unless indicated otherwise the averages in every table are for stature without shoes and weight without clothing.

7. Perhaps a note on the column headed "Time" is in order. The figures given in this column in parentheses refer to publication date of the study. The figures not so enclosed give the year or years during which the data were being accumulated.

8. The possibility of bias in the choice of averages may be dismissed. No other studies using similar samples were accessible.

9. Bowditch, H. P.: The Growth of Children: A Supplementary Investigation, in Tenth Annual Report of the State Board of Health of the State of Massachusetts, 1879, pp. 35-62.

10. MacDonald, A.: Experimental Study of Children, Including Anthropometrical and Psycho-Physical Measurements of Washington School Children, in Report of Commissioner of Education, United States Department of the Interior, Bureau of Education, 1897-1898, vol. 1, pp. 985-1204.

11. Gebhart, J. C.: The Growth and Development of Italian Children in New York City, Health Series, no. 3, New York Association for Improving the Conditions of the Poor, 1924.

12. Hrdlicka, A.: Anthropological Investigations on One Thousand White and Colored Children of Both Sexes, the Inmates of the New York Juvenile Asylum, with Additional Notes on One Hundred Colored Children of the New York Colored Orphan Asylum, New York, Wynkoop, Hallenbeck, Crawford Co., [1900].

What conclusions on secular change may tables 1 and 2 be considered to substantiate? After making generous allowance for sampling errors, for any remaining bias in racial and socioeconomic selection and for differences possibly associated with geographic area, it appears reasonable to infer that the average 9 year old white boy is no less than 6 per cent taller and 12 to 14 per cent heavier today than was the case half a century ago.

Table 3 presents averages for stature and weight for 14 year old boys obtained in five investigations published between 1877 and 1936. Compared with the 1877 [13] study, the study published in 1936 [14] will be seen to report averages 6 inches (15 cm.), or 10 per cent, higher for stature and more than 14 pounds (6.4 Kg.), or 16 per cent, greater for weight. What factors other than those associated with time might account for portions of these differences? Although Ireland and Netherlands are both countries of Northwest Europe, it is possible that a fraction of the differences is due to what might be termed lineal, or group, homogeneity within the broader designation of Northwest European ancestry. The probability that a portion of each difference may be due to socioeconomic selection (that is, that the Bowditch sample was the less weighted with members of the higher income or better cultural levels) can neither be dismissed nor reasonably assumed. In both of these studies, as well as in the other three for which data are given in table 3 (Collins and Clark,[15] Stiles and Wheeler [16] and Peckham [17]), the samples were drawn from schools. Geographic location varies between Holland, Mich., and Boston. In an analysis of data collected in 1922-1924, Palmer and Collins [18] found practically no difference between the average statures and weights of white children living in north central cities and of those living in northeastern cities. There remains an allowance for other uncontrolled factors and for sampling errors.

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13. Bowditch, H. P.: The Growth of Children, in Eighth Annual Report of the State Board of Health of the State of Massachusetts, 1877, pp. 273-324.

14. Steggerda, M., and Densen, P.: Height, Weight, and Age Tables for Homogeneous Groups, with Particular Reference to Navaho Indians and Dutch Whites, Child Development **7**:115-120, 1936.

15. Collins, S. D., and Clark, T.: Physical Measurements of Boys and Girls of Native White Race Stock (Third Generation Native Born) in the United States, Pub. Health Rep. **44**:1059-1083, 1929.

16. Stiles, C. W., and Wheeler, G. A.: Heights and Weights of Children: Classification by Age and by Sanitation of 1,652 White School Children (Seven Hundred and Seventy-One Boys, Eight Hundred and Eighty-One Girls) in the City of X, Pub. Health Rep. **30**:2990-3003, 1915.

17. Peckham, G. W.: The Growth of Children, in Sixth Annual Report of the State Board of Health of Wisconsin, 1881, pp. 28-73.

18. Palmer, C. E., and Collins, S. D.: Variations in Physique and Growth of Children in Different Geographic Regions of the United States, Pub. Health Rep. **50**:335-347, 1935.

TABLE 3.—*Average Stature and Weight of Fourteen Year Old Boys in the United States of North European Ancestry and All Socioeconomic Classes*

Stature, Inches	Weight, Pounds	Number of Subjects	Ancestry	Socioeconomic Status	Place	Time	Investigator
63.8	101.1	192	Dutch *	Schools	Holland, Mich.	(1936)	Steggerda and Densen [14]
61.2	99.4 †	1,317	"Native white" ‡	Schools	Numerous cities §	1922-1924 (1929)	Collins and Clark [15]
59.6	93.7 †	58	White ‖	Schools	Southern city of X ¶	1915 (1915)	Stiles and Wheeler [16]
58.7	89.7 †	36	"Pure American" ‡	Schools	Milwaukee	(1881)	Peckham [17]
57.8	87.1 †	398	Irish #	Schools	Boston	(1877)	Bowditch [18]

* "...only those whose ancestors came from the Netherlands were used..."
† Weight in indoor clothing.
‡ Both parents and all grandparents were born in the United States.
§ Twenty-two "fairly large cities" located in the northeastern and the north and south central states and Utah.
‖ "...white school children, nearly all American and southern born..."
¶ "...situated in the sandy coastal plain..."
# "...both parents Irish"; children almost entirely American born.

TABLE 4.—*Average Stature and Weight of Fourteen Year Old Negro Boys in the United States*

Stature, Inches	Weight, Pounds	Number of Subjects	Ancestry	Socioeconomic Status	Place	Time	Investigator
64.1	112.9 *	217	"Negro"	"School children"	Los Angeles	1936-1937 (1941)	Lloyd-Jones [19]
63.1 †	105.8 *	103	"Negro"	Not discussed ‡	Chicago, Washington, New York	1926-1935 (1938)	Beckham [20]
61.8	98.1	120	"Negro, degrees of mixture"	"All socioeconomic levels"	Kansas City, Kan.§	(1937)	McLendon [21]
60.1	100.0 ‖	109	"Negro, highly mixed"	"Near the poverty line"	New York (Negro district of Harlem)¶	1923-1924 (1924)	Herskovits [22]
58.4	95.5 #	50	"Colored"	Public schools	Kansas City, Mo.	1886-1890 (1891)	Greenwood [23]
58.0	90.9 #	282	"Colored"	"School children"	Washington, D. C.	(1899)	MacDonald [10]

* Conditions of weighing not treated; it is not known whether the subjects were nude or wearing indoor clothing.
† Not specifically stated that stature was determined without shoes.
‡ The data appear to have been accumulated while the author was carrying on psychologic work with school children.
§ Subjects were "...students at North East Junior High School and Summer High School..."
‖ Weight in shoes and indoor clothing (stature taken in shoes but height of heel deducted).
¶ Children of "Public School 89, Manhattan, New York City."
# Weight in indoor clothing.

It appears that a marked change with time in the average stature and weight of 14 year old white boys between 1880 and the present may be unequivocally posited. The Steggerda and Densen values given in table 3 have recently been reenforced by the results of a study by Lloyd-Jones.[19] The averages reported by Lloyd-Jones for the stature and weight of 5,398 "white" children aged 14 years examined in Los Angeles schools during 1936-1937 were 63.3 inches (160.8 cm.) and 109.8 pounds (49.8 Kg.). By combining these results with those given in table 3, it appears that 14 year old white boys of today average no less than 8 per cent more in stature and 15 per cent more in weight than boys of like age who lived five to six decades ago.

Averages for stature and weight obtained in six investigations (Lloyd-Jones,[19] Beckham,[20] McLendon,[21] Herskovits,[22] Greenwood,[23] MacDonald[10]) on 14 year old Negro boys are given in table 4. The most divergent figures of this table are those reported by MacDonald[10] for a sampling of 282 Washington, D. C., school children examined prior to 1900 and those given by Lloyd-Jones for a sample of 217 Los Angeles school children examined roughly forty years later. The average values from the latter investigation will be seen to exceed those from the former by 6 inches (15 cm.), or 10 per cent, in stature and by over 20 pounds (9.1 Kg.), or 22 per cent, in weight. As in the case of the 14 year old white boys, after generous allowance has been made for sampling errors, for residual socioeconomic and ancestral factors and for factors possibly associated with geographic region, there remain secular differences for Negro boys amounting to over 8 per cent in average stature and upward of 15 per cent in average weight.

The fact of a biologic trend in the direction of markedly increased stature and weight should be distinguished from particular attempts to explain that fact causally. Causal explanation to date cannot be considered to reach beyond logical inference and a number of tentative hypotheses awaiting verification. Many writers (Meredith,[2] pages 3-25 and 35) have interpreted the increases as probably related to advances

19. Lloyd-Jones, O.: Race and Stature: A Study of Los Angeles School Children, Research Quart. **12**:83-97, 1941.

20. Beckham, A. S.: A Study of Weight and Stature of Negro City Children of Adolescent Age, Human Biol. **10**:124-135, 1938.

21. McLendon, J. B.: Standards of Nutritional Status for Negro High School Boys, M. A. Thesis, University of Iowa Graduate School, 1937.

22. Herskovits, M. J.: Some Observations on the Growth of Colored Boys, Am. J. Phys. Anthropol. **7**:439-446, 1924; The Anthropometry of the American Negro, New York, Columbia University Press, 1930.

23. Greenwood, J. M.: Heights and Weights of Children, in Twentieth Annual Report, Board of Education, Kansas City Public Schools, Kansas City, Mo., 1891, pp. 48-56; Proceedings of the American Public Health Association, 1891, Concord, N. H., Republican Press, 1892, pp. 199-204.

in knowledge of dietary requirements, to increased immunization against disease and better medical care, to improved housing and sanitary conditions and to greater emphasis on outdoor recreations. Mills [24] has posited a causal relation between changes in climatic environment and secular variation in size. He has expressed the view that a cool dry climate facilitates loss of body heat and thereby stimulates growth, whereas a hot moist climate makes heat loss difficult and, as a consequence, suppresses growth.[25] An interpretation that the increase in average stature has possibly been brought about through the reduction of infant and child mortality has been vigorously advocated by Hooton,[26] who stated:

> According to this theory, the long skinny babies are constitutionally inferior to those of shorter, more compact build. Under the old crude conditions hordes of these weedy infants were eliminated early in life by the process which is called natural selection. Now, by artificial feeding and the extension and application of medical knowledge, many of them are saved to grow to excessive stature at maturity. . . .

The reader is cautioned that Hooton does not cite evidence to support the tenability of his position. Further, three notations are relevant:

1. It is not known that "long" babies become adults of "excessive stature." On the contrary, there is evidence indicating that children tall during the elementary school years are frequently not tall during adolescence [27] and suggesting that infants "long" at birth often are of medium stature during childhood or in adult life.[28]

2. The reference to "skinny . . . weedy" infants, if I interpret it as Hooton intended, is misleading. Joint consideration of the measure-

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24. Mills, C. A.: Geographic and Time Variations in Body Growth and Age at Menarche, Human Biol. **9**:43-56, 1937.

25. In my opinion Mills has greatly overemphasized the influence of temperature and humidity on human growth. This opinion stems mainly from consideration of two question. First, in view of the low relation between the body size of people living in different parts of the world and the climatic differences between various parts of the earth, is it reasonable to assume that changes in the climate in the United States during the last half century could have caused increases in stature and weight of the magnitude portrayed in tables 1 to 4? Second, since Mills has stated that there has been a definite rise in world temperature dating from 1920 and a worldwide heat wave over the years 1929 to 1934, why have not children born and reared during these years been found to average less in stature and weight than those born and reared during the three or four decades immediately preceding?

26. Hooton, E. A.: Twilight of Man, New York, G. P. Putnam's Sons, 1939, p. 223.

27. Meredith, H. V.: Stature of Massachusetts Children of North European and Italian Ancestry, Am. J. Phys. Anthropol. **24**:301-346, 1939.

28. (*a*) Simmons, K., and Todd, T. W.: Growth of Well Children: Analysis of Stature and Weight, Three Months to Thirteen Years, Growth **2**:93-134, 1938. (*b*) Meredith.[27]

ments of stature and weight for recent decades tends not to support the position that children are becoming "lighter relative to their weight" (Meredith,[2] page 35). Gains in stature have been paralleled by gains in weight.

3. Not only does there appear to be a complete lack of data suggesting that tall children have poor survival value, but Hooton himself has presented some observations which seemingly are inconsistent with this position. He wrote: "Some of the tallest stocks in this country live in areas where diet is insufficient and veritably atrocious, and where doctors are almost nonexistent, but many kinds of constitutional and infectious diseases run riot." [26]

Hooton himself has acknowledged that his theory "may be quite wrong." Elsewhere he has succinctly written that to date "no one really knows the cause." [29]

Trustworthy appraisement of secular changes in body size cannot be made if one is given only the changes themselves. Increased stature and weight do not necessarily constitute evidence of physical improvement—or of its opposite. Numerous investigators and clinicians have "assumed that additions to human stature are 'advantageous' and gains in body weight indicative of 'definite racial betterment'" (Meredith,[2] page 36). Hooton has favored the opinion that such changes are "on the whole, unfavorable" (Hooton,[26] page 220). It is in the best interests of clear thinking and the furtherance of research to recognize frankly that:

1. The evaluation of secular changes in stature and weight will require more extensive study than has been necessary for the discovery of the changes.

2. When the trend toward greater stature and body weight during recent decades is rigorously evaluated against appropriate criteria (that is, criteria representing health, efficiency and longevity), it is possible that it may be found "desirable, undesirable, or unrelated to the criteria" (Meredith,[2] page 36).

That children of the United States of elementary and high school age have been gradually increasing in stature and weight during the last half century is an established fact. Discovery of the causal factors and valid appraisement of this fact are research frontiers.

RELATION OF SOCIOECONOMIC STATUS TO AVERAGE STATURE AND WEIGHT

Average stature and weight of 9 year old boys obtained from three studies of socioeconomic status are presented in table 5. The Bowditch study utilized sons of American-born parents residing in Boston prior

29. Hooton, E. A.: Up from the Ape, New York, The Macmillan Company, 1932, p. 258.

to 1880. The 379 subjects examined at the age of 9 years were classified into two groups on the basis of information obtained on "occupation of father." On comparing the averages for the stature and weight of boys whose fathers were engaged in professional and mercantile occupations with the corresponding averages for boys whose fathers were employed at skilled and unskilled occupations, it will be seen that the former exceeded the latter by approximately ½ inch (1.3 cm.) in stature and 1 pound (0.5 Kg.) in weight.

My study drew on data for boys of North European descent which were accumulated in Massachusetts during 1925 and 1926.[30] Each value for stature and weight was assigned to one of three occupational categories. Table 5 shows that slightly higher averages were obtained (*a*) for the professional and important managerial occupations than for the smaller business and skilled occupations and (*b*) for the small business and skilled occupations than for the semiskilled and unskilled occupations. The averages for the unskilled and semiskilled category are lower than those for the professional and managerial category by roughly ¾ inch (1.9 cm.) in stature and 3 pounds (1.3 Kg.) in weight.

In the third investigation, that by Weisman,[31] comparison was made between two fairly extreme social groups sampled at Minneapolis in 1932-1933. The one sample was secured at schools in the "best districts" of the city and the other sample at schools in the "poorest districts." For 9 year old boys the former sample gave larger averages than the latter by somewhat more than 1 inch (2.5 cm.) in stature and 2 pounds (0.9 Kg.) in weight. Weisman did not show that the two groups were reasonably equivalent in racial composition.

Observe that in no instance does table 5 yield a socioeconomic difference equal to as much as one-half the differences reported in the previous section for 9 year old boys of comparable socioeconomic status but living fifty years separated in time. Note also that within table 5 there is evidence of predominance of the secular trend over socioeconomic variations. The averages for stature, for example, form a progressive series. Specifically, the boys measured at schools in the poorest districts of Minneapolis in 1932-1933 were no shorter than boys of the professional and managerial classes drawn from schools in the vicinity of Boston in 1925-1926; and, in turn, the sons of unskilled and semiskilled workers measured in 1925-1926 were taller than the sons of men holding professional and mercantile positions measured during the 1870's.

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30. Dearborn, W. F.; Rothney, J. W. M., and Shuttleworth, F. K.: Data on the Growth of Public School Children (from the Materials of the Harvard Growth Study), in Monographs of the Society for Research in Child Development, Washington, D. C., National Research Council, 1938, vol. 3, no. 1.

31. Weisman, S. A.: Contour of the Chest in Children: II. According to Weight and Height; III. Environment, Am. J. Dis. Child. **49**:47-59 (Jan.) 1935.

The most contrasting socioeconomic groups of boys of the United States that have been compared appear to be those studied by Boas.[32] In 1923 Boas reported a comparison of average statures of "children of Jewish descent in expensive private schools" and corresponding averages for "Hebrew . . . orphan children" (Boas,[32] page 306). He found that over the age period 5 to 14 years the sons of the "well-to-do parents" on the average were 2½ inches (6.4 cm.) taller than the "children of the poor." This difference is double the magnitude of the largest difference shown in table 5. Unfortunately, Boas did not make clear whether the data for private school children were collected over the same span of years as those for the orphans or to what extent he considered the ethnic derivation of the two "Jewish" samples comparable.

The averages for children 14 years of age were 58.6 inches (148.9 cm.) for the orphan sample and 60.7 inches (154 cm.), or 2.1 inches (5.3 cm.) higher, for the private school sample. This difference is equivalent to less than one-half the total divergence obtained for average stature of 14 year old Jewish boys reported in studies at other times. Employing data collected from 1908 to 1910 on American-born Jewish boys residing in congested districts of New York city, Boas [33] obtained an average for stature of 58.7 inches (149 cm.). An average stature of 63.4 inches (170 cm.), or 4.7 inches (11.7 cm.) higher, was obtained by Gray and Ayres [34] for Jewish boys attending upper class private schools during the decade 1920 to 1930. Incidentally, Boas' 1923 average stature of 60.7 inches for Jewish boys attending "expensive private schools" is 1.8 inches (4.6 cm.) lower than the average reported by Snow [35] for 14 year old Jewish boys measured in 1935-1936 at the Schurtliff School, of Chelsea, Mass., who were shown to be of "middle class" status.

The available research on socioeconomic status is too limited to permit highly dependable statements on the magnitude of the differences in stature and weight between various socioeconomic groups. Obviously, the magnitude of the differences would be expected to vary with the size and position of the segments of the socioeconomic distribution being compared. Greater differences would be expected from com-

32. Boas, F.: The Growth of Children as Influenced by Environmental and Hereditary Conditions, School & Soc. **17**:305-308, 1923.

33. Boas, F.: Changes in Bodily Form of Descendants of Immigrants, Document 208, United States Senate, Sixty-First Congress, Second Session, in Reports of the Immigration Commission, Washington, D. C., Government Printing Office, 1911.

34. Gray, H., and Ayres, J. G.: Growth in Private School Children, Chicago, University of Chicago Press, 1931.

35. Snow, C. E.: Comparative Growth of Jewish and Non-Jewish Pupils in a Greater Boston Public School, Ph.D. Thesis, Harvard University Graduate School, 1938.

TABLE 5.—*Average Stature and Weight of Nine Year Old Boys in the United States of Varying Socioeconomic Status*

Stature, Inches	Weight, Pounds	Number of Subjects	Ancestry	Socioeconomic Status	Place	Time	Investigator
52.9	62.7 *	149	.....	"Best districts" †	Minneapolis	1932-1933 (1935)	Weisman [21]
51.7	60.3 *	145	.....	"Poorest districts" ‡			
51.5	63.1 §	56	North European	Professional, managerial ‖	Vicinity of Boston ¶	1925-1926 (Unpublished)	Meredith
51.1	61.2 §	204	North European	Small business, skilled #	Vicinity of Boston ¶		
50.7	59.5 §	126	North European	Unskilled, semi-skilled **	Vicinity of Boston ¶		
49.5	58.0 §	137	Both parents American born	"Non-laboring" ††	Boston	(1879)	Bowditch [9]
49.0	56.9 §	242		"Laboring" ‡‡			

* Median weight: "...discarding of clothes was limited to stripping to the waist and removing the shoes."
† Children attending representative schools in the best sections of Minneapolis.
‡ Children attending representative schools in the poorest sections of Minneapolis.
§ Weight in indoor clothing.
‖ Twenty-five per cent belonged to occupational group I (professional) and 75 per cent to group II (semiprofessional and important managerial), Harvard Growth Study.
¶ Medford, Beverly and Revere, Mass.
# Occupational group III (small business, minor managerial, skilled), Harvard Growth Study.
** Seventy per cent belonged to occupational group IV (semiskilled) and 30 per cent to group V (unskilled), Harvard Growth Study.
†† Professional and mercantile occupations.
‡‡ Skilled and unskilled occupations.

TABLE 6.—*Average Stature and Weight of Nine Year Old Boys in the United States of Similar Stature and Various Ethnic Groups*

Stature, Inches	Weight, Pounds	Number of Subjects	Ancestry	Socioeconomic Status	Place	Time	Investigator
49.7	58.4	76	Japanese *	"All walks of life" †	Los Angeles	(1933)	Suski [37]
49.7	56.9 ‡	217	Mexican §	Elementary schools	Laredo and El Paso, Texas	1930 (1934)	Manuel [38]
49.6	53.6	48	Pueblo Indian	Poor diet, housing ‖	New Mexico, Arizona	1934 (1937)	Dunham and associates [39]
49.5	57.4 ‡	39	"Pure American" ¶ (North European)	Public schools	Milwaukee	(1881)	Peckham [17]
49.4	....	41	Bohemian # (Central European)	"Congested districts"	New York City	1908-1910 (1911)	Boas [33]
49.4	58.6 ‡	75	Italian (South European)	Laborers, semi-skilled **	Vicinity of Boston ††	1925-1926 (Unpublished)	Meredith
49.3	59.0 ‡	303	Negro	"School children"	Washington, D. C.	(1899)	MacDonald [10]
49.1	53.6	120	Chinese	Crowded housing, poor diet	San Francisco	1935 (1936)	Wong and Lee [40]
49.1	....	103	Jewish # (East European)	"Congested districts"	New York City	1908-1910 (1911)	Boas [33]
49.0	51.6 ‡	320	German	Public schools	Milwaukee	(1881)	Peckham [17]

* Parents full-blooded Japanese, children American born.
† "....from unskilled laborers to business men, manufacturers, or literary and professional people."
‡ Weight in indoor clothing.
§ It was stated that individual subjects varied from a predominantly Spanish to a predominantly Indian mixture.
‖ Diet "poor in quality and quantity." Houses "built of adobe...family usually sleep in one room...almost complete lack of sanitary arrangements."
¶ White; "both parents and all grandparents born in the United States."
# Subjects American born.
** Occupational groups IV (semiskilled) and V (unskilled), Harvard Growth Study.
†† Revere, Medford and Beverly, Mass.

parison of a "professional" group with an "unskilled" group than from comparison of a "managerial and commercial" group with a "skilled and semiskilled" group. With regard to children of elementary and high school age living in the United States at the present time and representing a given locality and racial lineage, it appears reasonable to estimate tentatively that the difference between those of the professional and managerial classes and those of the unskilled and semiskilled classes does not exceed 3 per cent in average stature or 6 per cent in average weight. Numerous analyses of data collected during the last twenty years have been reported for elementary and high school children drawn predominantly from the upper classes.[36] The crucial need is for comparable studies on children of the lower classes.

To date, the explanation of differences in stature and weight between different socioeconomic groups is not known. Among the factors possibly contributing must be listed diet, housing conditions, health practices, occupational demands and selective mating. In this connection it is pertinent to recognize that, at best, "socioeconomic status" is a loosely defined concept acknowledged to be but crudely estimated from information about such points as the occupation of the father and the family income. Undoubtedly, as more intensive study is made of the relation between body size and such factors as nutrition, sanitation, immunization, exercise and rest the term socioeconomic status will either be discarded or subjected to more precise definition.

RELATION OF RACE TO AVERAGE STATURE AND WEIGHT

Are there racial differences in stature and weight? This question cannot be meaningfully discussed if a common concept of the word "racial" is lacking. For one person the word may carry the connotation: Have the children of Chinese ancestry living in San Francisco been found to differ in stature and weight from the children of Dutch ancestry living in Holland, Mich.? To another person it may imply: When allowance is made for the wide variation in the living conditions of such Dutch and Chinese groups during the past century and at the present time (that is, variation in such matters as diet, housing and geographic location) do there remain differences in stature and weight which are uniquely racial? The latter person would be employing "racial" in a strongly hereditary and nonadaptive sense, while the former

36. (*a*) Meredith, H. V.: The Rhythm of Physical Growth: A Study of Eighteen Anthropometric Measurements of Iowa City White Males, Studies in Child Welfare, Iowa City, University of Iowa, 1935, vol. 11, no. 3. (*b*) Richey, H. G.: The Relation of Accelerated, Normal, and Retarded Puberty to the Height and Weight of School Children, in Monograph of the Society for Research in Child Development, Washington, D. C., National Research Council, 1937, vol. 2, no. 1. (*c*) Gray and Ayres.[34] Simmons and Todd.[28a]

would be using the term without reference to hereditary or environmental restrictions.

Hooton, one of the foremost physical anthropologists, defines race in the following manner:

> A race is a great division of mankind, the members of which, though individually varying, are characterized as a group by a certain combination of morphological and metrical features, principally non-adaptive, which have been derived from their common descent. (Hooton,[29] page 397.)

According to this definition, stature and weight can be considered satisfactory criteria of "racial differences" only if they are "principally nonadaptive" (that is, if hereditary variations can manifest themselves largely "unimpeded and unmodified" by environmental stimuli). Hooton has expressed the opinion that stature and weight are physical characteristics which "seem easily modifiable . . . through the action of environmental factors" and, consequently, "can not be trusted as criteria of race" (Hooton,[29] page 399).

Many writers are more willing to concede the impingement of environmental factors in the case of weight than in the case of stature. Table 6 has been constructed to show data obtained in ten studies (Suski,[37] Manuel,[38] Dunham and associates,[39] Peckham,[17] Boas,[33] Meredith, MacDonald,[10] Wong and Lee,[40] Boas,[33] Peckham [17]) on groups of boys in the United States as diverse as possible in ethnic origin yet practically identical in average stature. The data in the table are decisive with regard to the untenability of the position that stature varies with race and is fairly rigorously nonadaptive. To assume that the average stature of a group of 9 year old boys of similar ancestry is genetically determined, it is necessary to credit "genetic determiners" with having produced like results in boys of Negroid, Mongoloid and white stocks; in boys of Nordic, Mediterranean and Armenoid derivation, and in boys of Mexican and American Indian ancestry.

Table 7 affords several comparisons of averages for stature and weight for 14 year old boys of varying ethnic descent. The first comparison is for two samples, one of Finnish and the other of Italian ancestry. Both were drawn in the vicinity of Hibbing, Minn., and both were examined during 1938-1939 by the same anthropometrist

37. Suski, P. M.: The Body Build of American-Born Japanese Children, Biometrika **25**:323-352, 1933.

38. Manuel, H. T.: Physical Measurements of Mexican Children in American Schools, Child Development **5**:237-252, 1934.

39. Dunham, E. C.; Aberle, S. D.; Farquhar, L., and D'Amico, M.: Physical Status of Two Hundred and Nineteen Pueblo Indian Children, Am. J. Dis. Child. **53**:739-749 (March) 1937.

40. Wong, T. A., and Lee, S. D.: Anthropometric Study of the San Francisco Chinese: Final Report, Statistical Project 65-3-4229, W. P. A. Work Project 3330, 1936.

TABLE 7.—*Average Stature and Weight of Fourteen Year Old Boys in the United States in Paired Ethnic Groups*

Stature, Inches	Weight, Pounds	Number of Subjects	Ancestry	Socioeconomic Status	Place	Time	Investigator
62.5	101.3	75	Finnish	Mean income, approximately $1,000 *	Hibbing, Minn.†	1938-1939 (Unpublished)	Matheny and Meredith
61.2	99.9	80	Italian				
63.3	100.8	5,398	White	Schools	Los Angeles	1936-1937 (1941)	Lloyd-Jones [19]
61.6	103.7	774	Mexican				
60.7	100.6	153	Japanese				
63.8	101.1	192	Dutch	Schools ‡	Holland, Mich.	(1936)	Steggerda and Densen [14]
60.5	....	431	Polish	Schools ‡	Hamtramck, Mich.§	1938(?) (Unpublished)	Courtis [42]
61.1	99.0	74	Chinese ‖	Fairly low ¶	Six cities ¶	1940-1941 (Unpublished)	Lowe [48]
60.6	90.7	196	Navajo Indian #	Reservation schools	New Mexico, Arizona	(1936)	Steggerda and Densen [14]
59.2	88.7 **	100	Chinese	"Chinatown" ††	San Francisco	1935 (1936)	Wong and Lee [40]

* Unskilled and semiskilled classes, such as sons of miners and W. P. A. workers.
† Communities within a radius of 50 miles of Hibbing.
‡ "Schools" in these two instances no doubt symbolizes decidedly different socioeconomic distributions.
§ "...a city of 50,000 population, entirely surrounded by Detroit, formerly 80 per cent Polish."
‖ Mainly second generation American born.
¶ Below average; housing conditions and occupational grades of Chinese stated to be particularly low in New York and San Francisco and somewhat better in Oakland and Los Angeles. Socioeconomic status of subjects residing in Chicago and Detroit was not discussed.
# "...those known to have any white blood were excluded..."
** Clothed below the waist.
†† Crowded housing; in 50 per cent of the cases the father was engaged at unskilled or semiskilled occupations.

(Matheny). The occupational distribution and average family income were practically identical for each sample. While only a slight difference is registered in average weight, the average stature of the Italian boys is somewhat over 1 inch (2.5 cm.) less than that of the Finnish boys. With reference to the combined factors of time, locality, socioeconomic status, occupation and measurement procedure, these samples appear to manifest a unique degree of homogeneity. However, it is possible that the difference in stature accrues in part from sampling errors and in part from uncontrolled environmental stimuli. Similar samples taken from each of the next few generations may not continue to give a larger average stature for boys of Finnish descent than for those of Italian lineage.

In a study published in 1939,[27] I compared the average statures of boys of Italian stock and boys of North European stock. The data were accumulated by the Harvard Growth Study at Beverly and Revere, Mass., during the years 1923 to 1934. They consisted of seriatim annual measurements of 80 Italian boys and 157 North European boys extending over the age period 7 to 17 years. Throughout the entire decade the North European boys on the average were approximately 1¾ inches (4.5 cm.) taller than the Italian boys. A small portion of this difference may be due to the fact that about three fifths of the Italian subjects were drawn from the unskilled and semiskilled classes while only two fifths of the North European subjects were so drawn. Of particular interest was the observation that the difference between the two groups did not become greater with advancing age. The gain in average stature over the period of observation was 20.9 inches (53 cm.), or 45.0 per cent, for the North European boys and 20.8 inches (52.8 cm.), or 46.4 per cent, for the Italian boys.

The second series of comparative figures given in table 7 are taken from a recent study by Lloyd-Jones.[19] They are based on data collected in Los Angeles schools during the interval 1936-1937. The averages for 14 year old boys of Japanese ancestry are lower than the corresponding averages for boys (*a*) of Mexican ancestry, by 3 pounds (1.3 Kg.) and almost 1 inch (2.5 cm.), and (*b*) of white ancestry, by 9 pounds (4.1 Kg.) and 2½ inches (6.4 cm.). Comparable averages for Japanese boys have been reported by Preston [41] and by Suski.[37] Preston, from data collected in San Francisco in 1931, obtained averages for stature and weight for 11 first generation American-born Japanese boys of 59.9 inches (150 cm.) and 98.8 pounds (44.8 Kg.). Suski, in 1933, reported averages of 61.3 inches (163 cm.) and 102.1 pounds (46.3 Kg.), which were derived from examination of 37 Japanese boys residing in Los Angeles and considered representative of "all walks of life." It will

41. Preston, M. I.: Growth of Oriental Children in San Francisco: A Contrast, Am. J. Dis. Child. **51**:1324-1348 (June) 1936.

be seen that the averages for Japanese reported by Lloyd-Jones lie between those of Preston and Suski. Lloyd-Jones neither described the socioeconomic status of the various ethnic groups represented in the Los Angeles schools nor indicated to what extent the differences obtained might be due to systematic variations in such items as diet, housing, medical care, clothing and outdoor recreation.

Lloyd-Jones's study covered the age period 5 to 18 years. The differences between comparable averages for children of white and Japanese ancestry tended to remain the same throughout the childhood years and (in contrast to the observation previously cited for children of Italian and North European ancestry) to increase during the adolescent years. The gain in average stature between the ages of 5 and 13 years was 16.4 inches (42 cm.), or 37.1 per cent, for white boys and 16.2 inches (41 cm.), or 38.3 per cent, for Japanese boys. Between the ages of 13 and 18 years the gain was 8.0 inches (20 cm.), or 13.3 per cent, for the former and 6.6 inches (17 cm.), or 11.3 per cent, for the latter. Over the full age span, 5 to 18 years, the increase in average stature was 24.4 inches (62 cm.), or 55.3 per cent, for the white boys; 23.5 inches (60 cm.), or 54.8 per cent for the Mexican boys, and 22.8 inches (58 cm.), or 53.9 per cent, for the Japanese boys. In actual size at each age and, consequently, in gain for the entire period, the Negro boys closely approximated the white boys.

The third comparison shown in table 7 is for schoolboys of Dutch descent living in Holland, Mich. (Steggerda and Densen [14]), and schoolboys of Polish descent living in Hamtramck, Mich. (Courtis [42]). Here the difference in average stature exceeds 3 inches (8 cm.). It appears that a fairly large part of this difference may be due to socioeconomic selection. There is marked divergence in density of population and typical living conditions between Hamtramck and Holland, Mich. As reported, the average stature of the boys "whose ancestors came from the Netherlands" is higher than that reported by Lloyd-Jones for Los Angeles "white" schoolboys, and the average stature of boys whose ancestors came from Poland is fully as low as that reported by Lloyd-Jones for "Japanese" schoolboys in Los Angeles.

The final series of comparative figures is for 14 year old boys of Chinese and Navajo Indian descent (Lowe,[43] Steggerda and Densen,[14] Wong and Lee [40]). The two sets of Chinese averages are difficult to harmonize. They differ by 10 pounds (4.5 Kg.) in average weight and almost 2 inches (5 cm.) in average stature. Among the items which

42. Courtis, S. A.: Stature of Boys of Polish Ancestry, read at the meeting of the American Education Research Association, Cleveland, February 1939.

43. Lowe, E. R.: The Growth of Cantonese Boys in the United States, M. A. Thesis, University of Iowa Graduate School, 1941.

may account for small amounts of these differences, the following must be listed:

1. The Lowe [43] study was made five years later than that by Wong and Lee.[40]

2. The Lowe study sampled a larger geographic area and a somewhat wider zone of socioeconomic status than did the study of Wong and Lee.

3. Although practically all persons of Chinese ancestry living in the United States trace their origin to the single province of Kwangtung, South China, one study may be lineally less homogeneous than the other as a consequence of subgroup differences resulting from the infrequency of "intermarriage between families that trace their descent from different villages in China" (Lowe,[43] page 1).

The average stature obtained by Steggerda and Densen [14] for Navajo boys will be seen to be practically identical with the Lloyd-Jones average for Japanese boys and the Courtis [42] average for Polish boys.

Table 7 is considered to support the conclusion that children of the United States of certain ethnic groups—as similar as any that have been studied with regard to time of examination, geographic locality and socioeconomic status—show differences in average stature. Dutch children appear taller than Polish, Japanese or Navajo Indian, and Finnish children appear taller than Italian or Chinese. Children of Negro ancestry appear not to differ significantly from children of white ancestry, nor do children of Italian lineage differ from those of Mexican or Chinese lineage. If one considers groups which are reasonably comparable in secular, regional and socioeconomic factors, it seems unlikely that children of any racial stocks living in the United States today differ by more than 2 inches (5 cm.) in average stature. Whether any differences will be indicated when the Asiatic and South European sectors of the population have resided in the United States another generation or so is a question beyond the reach of contemporary research.

RELATION OF LOCALITY TO AVERAGE STATURE AND WEIGHT

This section has a twofold objective. It aims at (*a*) a synthesis of observations on stature and weight obtained from comparison of children living in rural areas with those living in urban areas and (*b*) an intercomparison of observations on stature and weight secured on urban children residing in various geographic regions.

Two series of results for 14 year old boys residing in different urban localities are presented in table 8. The upper series (Porter,[44] Green-

44. Porter, W. T.: The Growth of St. Louis Children, Tr. Acad. Sc. St. Louis **6**:263-280 and 46 pages of graphs, 1894.

wood,[23] MacDonald,[10] West,[45] Barnes,[46] Smedley [47]) is for white (mainly Northwest European) schoolboys examined during the closing decade of the nineteenth century. The lower series (Palmer and Collins,[18] Schwartz and associates,[48] Meredith, Bissett and Laslett [49]) is for similar samples drawn during the decade 1922 to 1931. For average stature, the six values of the lower series cluster within a zone of less than 1 inch (2.5 cm.), while the six values of the upper series fall over a range slightly exceeding 1 inch. In weight, the maximum variation between averages is 6 pounds (2.7 Kg.) for the lower series and 8 pounds (3.6 Kg.) for the upper. No marked systematic differences for different regions are indicated. The three highest averages for stature of the upper series represent Illinois, California and Massachusetts respectively. Represented by the three highest of the lower series are California, Massachusetts and New York.

It is noticeable that the highest weight average of each series is for subjects in California. Averages for stature in this location also rank high in both series. While no decisive conclusion appears warranted, citation of the results of two additional studies is relevant. From analysis of data on stature and weight accumulated during the Children's Year Campaign of 1918 on white subjects under 6 years of age, Woodbury [50] found that California children were slightly larger than children of the eastern or north central states. Lloyd-Jones,[19] in a study of data on stature and weight collected for white children attending Los Angeles schools during 1936-1937, found that children of elementary and high school age born and reared in California were slightly larger than children born elsewhere who had lived in California for a period of one to five years. Woodbury expressed the belief that his observations

45. West, G. M.: Anthropometrische Untersuchungen über die Schulkinder in Worcester, Mass., Amerika, Arch. f. Anthropol. **22**:13-48, 1894; Worcester School Children—The Growth of the Body, Head and Face, Science **21**:2-4, 1893.

46. Barnes, E.: Physical Development of Oakland Children, in Annual Report of the Public Schools of the City of Oakland, 1892-1893, pp. 38-44.

47. Smedley, F. W.: Report of Director of Department of Child-Study and Pedagogic Investigation, in Forty-Sixth Annual Report, Board of Education, Chicago Public Schools, 1900, pp. 47-116; Child Study in Chicago, Report of the Commissioner of Education, United States Department of the Interior, Bureau of Education, 1902, vol. 1.

48. Schwartz, L.; Britten, R. H., and Thompson, L. R.: Studies in Physical Development and Posture: II. Bodily Growth with Age, Public Health Bulletin 179, United States Treasury Department, Public Health Service, 1928, pp. 39-106.

49. Bissett, L., and Laslett, H. R.: A Study of Height, Weight, and Age Among High School Boys, J. Juvenile Research **16**:291-297, 1932.

50. Woodbury, R. M.: Statures and Weights of Children Under Six Years of Age, Publication 87, U. S. Department of Labor, Children's Bureau, 1921; Quart. Publ., Am. Statist. A. **17**:780-782, 1921; Am. J. Phys. Anthropol. **4**:269-273, 1921; **5**:279-282, 1921.

TABLE 8.—*Average Stature and Weight of Fourteen Year Old Boys in Various Urban Localities of the United States*

Stature, Inches	Weight, Pounds	Number of Subjects	Ancestry	Socioeconomic Status	Place	Time	Investigator
58.5	89.1 *	935	White (?)	Public schools	St. Louis	1892 (1894)	Porter [44]
58.6	93.5 *	347	"White"	Public schools	Kansas City, Mo.	1890 (1891)	Greenwood [23]
59.1	88.3 *	784	"White"	Schools	Washington, D. C.	(1899)	MacDonald [10]
59.4	92.1 *	c.110	North European	Schools	Worcester, Mass.	1891 (1893)	West [45]
59.7	97.0 *	c.230	North European	Schools	Oakland, Calif.	1892 (1893)	Barnes [46]
59.8	94.1 *	240	White †	Public schools	Chicago	1899 (1900)	Smedley [47]
61.2	99.7 *	397	"Native white" ‡	Schools	Northeastern cities §	1922-1924 (1935)	Palmer and Collins [18]
61.3	98.5 *	399	"Native white"	Schools	South central cities ‖	1922-1924 (1935)	Palmer and Collins [18]
61.3	101.0 *	468	"Native white"	Schools	North central cities ¶	1922-1924 (1935)	Palmer and Collins [18]
61.6	96.6	110	White #	Schools	New York City	(1928)	Schwartz and associates [48]
61.8	102.3 *	408	North European	Public schools	Towns in Massachusetts **	1930-1931 (Unpublished)	Meredith
61.9	102.9	82	Mainly North European (?)	Technical high school	Oakland, Calif.	1925-1930 (1932)	Bissett and Laslett [49]

* Weight in indoor clothing.
† "...largely of American parentage...well fed and clothed."
‡ "Both parents and all grandparents born in the United States."
§ Cities "of New England and Middle Atlantic States."
‖ Cities "from Kentucky to Texas."
¶ Cities in "States bordering the western Great Lakes."
# "...of native-born parentage."
** Beverly, Medford and Revere, Mass. (Harvard Growth Study data).

were due either to climate or to factors related to migration. Lloyd-Jones listed as "obvious components of this environment which might be considered unique . . . increased sunshine, greater variety of diet, more variation in vegetables and fruits and more hours of outdoor play, all stemming from the more equable climate prevailing in California." (Lloyd-Jones,[19] page 23.)

Attention is called to the fact that the most contrasting feature of table 8 is associated not with locality but with time. The six averages for stature representing the decade 1922 to 1931 approximate 61½ inches (156 cm.), while those for the decade 1890 to 1899 cluster around 59¼ inches (150 cm.). This difference of over 2 inches (6 cm.) is paralleled in the case of weight. The values for weight for 1890 to 1899 average 92½ pounds (42 Kg.), or 8 pounds (3.6 Kg.) lower than those for 1922 to 1931.

Table 9 affords three urban-rural comparisons for 9 year old boys. The first comparison is taken from an investigation by Brown,[51] reported in 1936. It shows that schoolboys of urban Utah were slightly taller and heavier than schoolboys of rural Utah. The second comparison, made in Missouri two decades earlier by Pyle [52] and Pyle and Collins,[53] shows the same urban-rural relation for stature as was obtained by Brown but registers no difference for weight. The observations reported by Woodbury [50] and by Tuxford and Glegg [54] are in contrast with those of Brown and of Pyle and Collins. Woodbury found that of children in the United States under 6 years of age those living in rural areas exceeded those from urban areas both in stature and in weight. A like result was obtained by Tuxford and Glegg for English children of school age. Table 9 gives the average values reported by the latter for boys 9 years of age. It is possible that the conflicting results may be due at least partially to the fact that the data for urban Utah and Missouri do not represent the older, more densely populated, highly industrial cities.

As factors which might cause differences in size in various geographic areas, Gray and Ayres [34] have listed the following:

1. Climate favoring general health by out-of-door life versus city life.

51. Brown, A. P.: Comparative Size of Rural and Urban Utah School Children as Determined by the Weight-Height-Age Relationship, Bulletin 266, Utah Agricultural Experiment Station, Logan, Utah, 1936.

52. Pyle, W. H.: A Manual for the Mental and Physical Examination of School Children (Revised), Univ. Missouri Bull. (Extension Ser.) **21** (no. 12): 1-39, 1920.

53. Pyle, W. H., and Collins, P. E.: The Mental and Physical Development of Rural Children, School & Soc. **8**:534-539, 1918.

54. Tuxford, A. W., and Glegg, R. A.: The Average Height and Weight of English School Children, Brit. M. J. **1**:1423-1424, 1911.

TABLE 9.—*Comparative Average Stature and Weight of Nine Year Old Boys in Urban and in Rural Localities*

Stature, Inches	Weight, Pounds	Number of Subjects	Ancestry	Socioeconomic Status	Place	Time	Investigator
52.1	61.8 *	647	90% North European	Schools	Urban Utah †	(1936)	Brown [51]
51.4	60.4 *	904	90% North European	Schools	Rural Utah ‡		
51.2	59.2 *	314	White	Schools	Urban Missouri §	1916-1919 (1920)	Pyle [52]
50.5	59.3 *	117	White	Schools	Rural Missouri ‖	1917 (1918)	Pyle and Collins [53]
47.8	53.3 *	6,460	English	Schools	Urban England ¶	(1911)	Tuxford and Clegg [54]
48.4	54.2 *	2,320	English	Schools	Rural England #		

* Weight in indoor clothing.
† Salt Lake City, Logan and Provo, Utah.
‡ County areas "outside of incorporated places having more than 2,500 inhabitants"; 21 of the 29 Utah counties were sampled.
§ "...small cities, chiefly in Missouri."
‖ "...the entire school population of...a typical Missouri county, the inhabitants being native Americans."
¶ Data from forty-four urban educational areas.
# Data from seventeen county educational areas.

2. Climate specifically stimulating or retarding growth, as by:
   a. Temperature effect.
   b. Iodine effect on the thyroid gland; shore line versus inland.
   c. Vitamin effect due to greater abundance of vegetables and fruits.

3. Accidental association between the region and . . . race or economic level. (Gray and Ayres,[34] page 204.)

SUMMARY

Joint consideration is given to race, class, time and region as these are related to the average stature and weight of children in the United States. Intercomparisons are made between averages available for upward of sixty samples of boys aged 9 or 14 years. Over the age period from 9 to 14, it is found that:

1. Boys living in the United States today, white and Negro, are 6 to 8 per cent taller and 12 to 15 per cent heavier than was the case half a century ago.

2. White boys of the professional and major managerial classes are taller and heavier than those of the unskilled and semiskilled classes. In magnitude the differences appear not to exceed 3 per cent for stature or 6 per cent for weight.

3. Boys in the United States of various ethnic groups (roughly comparable for socioeconomic status, geographic environment and decade of examination) in no instance appear to differ in average stature by more than 2 inches. The accessible averages for weight fluctuate so much that they preclude a reasonably precise estimate of the maximum difference for weight among ethnic groups.

4. Averages for stature and weight vary but slightly for white boys residing in different parts of the United States.

In general, secular differences covering the last half century are twice as large as any of the other differences considered. Geographic differences are of the smallest magnitude, while socioeconomic and ethnic differences are intermediate in size.

The need for additional studies in the areas encompassed by this paper is clearly indicated. Few investigations meet the criteria of having been rigorously executed and of affording comparative results which are not unnecessarily ambiguous because of the operation of controllable extraneous factors. The need is for comparative research which will (*a*) carefully define the anthropometric technics employed, (*b*) make explicit the procedures followed in grouping the data, (*c*) indicate the statistical mediums utilized in analysis and (*d*) study the differential effect of one item while holding the other three constant, for example, the differential effect of geographic location on two or more groups of children similar with respect to racial lineage, socioeconomic selection and time examined.

INTRADERMAL IMMUNIZATION

III. TYPHOID FEVER

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Many attempts have been made to immunize against typhoid fever by methods other than the usual subcutaneous administration of vaccine. Thus Moor and Brown [1] and Crimm and Short [2] reported that vaccination by the oral route gave rise to concentrations of agglutinins in the blood serum which were as high as those obtained by the subcutaneous method. Downs and Bond,[3] however, found that administration of typhoid vaccine by the oral route produced agglutinins in lower titers than those produced by subcutaneous injections.

In a previous report [4] we showed the efficacy of intradermal immunization against scarlet fever. In 1932 Tuft and his associates [5] recommended intradermal immunization against typhoid fever. Siler and Dunham [6] found that revaccination against typhoid fever by intracutaneous injection produced a satisfactory immunologic response. Tuft [7] recently showed, by means of mouse protection tests, that vaccination

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1. Moor, H. D., and Brown, I. L.: A Comparative Study of Oral and Subcutaneous Vaccination Against Typhoid Fever Based on Agglutination Titers, J. Lab. & Clin. Med. **22**:1216 (Sept.) 1937.

2. Crimm, P. D., and Short, D. M.: A Study of Oral Typhoid Vaccination as Measured by Blood Serum Agglutinins, Am. J. M. Sc. **196**:826 (Dec.) 1938.

3. Downs, C. M., and Bond, G. C.: Occurrence of O and H Agglutinins Following Subcutaneous and Oral Administration of Typhoid Vaccine, Am. J. Pub. Health **27**:889 (Sept.) 1937.

4. Fisher, S., and Van Gelder, D. W.: Intradermal Immunization: Scarlet Fever, Am. J. Dis. Child. **61**:88 (Jan.) 1941.

5. Tuft, L.; Yagle, E. M., and Rogers, S.: Antibody Response to Typhoid Vaccine, J. Infect. Dis. **50**:98 (Feb.) 1932.

6. Siler, J. F., and Dunham, G. C.: Duration of Immunity Conferred by Typhoid Vaccine: Results of Revaccination by Intracutaneous Injection of Typhoid Vaccine, Am. J. Pub. Health **29**:95 (Feb.) 1939.

7. Tuft, L.: Further Studies of the Intracutaneous Method of Typhoid Vaccination, Am. J. M. Sc. **199**:84 (Jan.) 1940.

by the intradermal method produced a satisfactory increase in the protective power of the blood. On the other hand, Wyandt and co-workers[8] obtained considerably greater antibody responses with use of the subcutaneous method than by the intradermal administration of the vaccine.

PRESENT INVESTIGATION

The purpose of this study was to compare the intradermal and subcutaneous methods of typhoid vaccination with respect to the severity of reactions and the concentrations of blood agglutinins produced.

Material and Methods.—Five hundred and eighty children from the Illinois Soldiers' and Sailors' Children's School at Normal, Ill., ranging in age from 1.5 to 19 years were immunized against typhoid fever. Prior to immunization all of the subjects had negative typhoid agglutination reactions. None of the children gave a history of previous vaccination against typhoid fever or of having had the disease. By random selection the children were divided into two groups. Group A (285 children) received the injections subcutaneously, while the children in group B (295 subjects) were given intradermal injections of the vaccine.

Agglutination tests were carried out by the Welch-Stuart rapid slide method[9] on all subjects before immunization and one month after completion of the course of vaccine. Injections were given alternately on the outer aspect of the upper part of the arm at two or three week intervals. The local reactions were measured, and a record was kept of every systemic reaction encountered. The size of the dose of vaccine administered to the children in both groups was determined by the weight of the individual subject. Those children weighing 120 pounds or over received the full adult dose. Subjects weighing between 90 and 120 pounds (40.8 and 54.4 Kg.) were given 87 per cent of the adult dose, those weighing between 60 and 90 pounds (27.2 and 40.8 Kg.) received 62 per cent of the maximal dose and the remainder, who weighed under 60 pounds, were given only 50 per cent of the adult dose.

The vaccine employed was supplied by the Illinois State Department of Public Health; 1 cc. of vaccine contained 1,000,000,000 typhoid bacilli (Panama strain). Dilutions of the vaccine were made with physiologic solution of sodium chloride, so that convenient amounts for injection of doses of various sizes could be used.

The 285 children in group A were given three injections of the typhoid vaccine subcutaneously. One hundred and sixty-six subjects received the injections at two week intervals, while the remaining 119 children were given the vaccine at three week intervals. The three doses of vaccine administered to the subjects in this group who weighed 120 pounds or over were 0.5 cc. (500,000,000 bacilli), 1.0 cc. (1,000,000,000 bacilli) and 1.0 cc. (1,000,000,000 bacilli). Those weighing less than 120 pounds received proportionately smaller doses, as was explained previously.

The 295 children comprising group B were all given intradermal injections of the typhoid vaccine. In order to determine the optimal intradermal dose this

8. Wyandt, H.; Bayliss, M.; Tollman, J. P., and Gunderson, M. F.: Intradermal Immunization, Nebraska M. J. **23**:140 (April) 1938.

9. Welch, H., and Stuart, C. A.: A Rapid Slide Test for Serologic Diagnosis of Typhoid and Paratyphoid Fever, J. Lab. & Clin. Med. **21**:411 (Jan.) 1936.

group was further subdivided into three subgroups. In subgroup 1, consisting of 89 children, the three doses administered to the subjects weighing 120 pounds or more were 0.05 cc. (50,000,000 bacilli), 0.1 cc. (100,000,000 bacilli) and 0.1 cc. (100,000,000 bacilli). Fifty-two of these children received the injections at two week intervals and the remaining 37 at three week intervals. In subgroup 2, comprising 100 children, the three doses given the children weighing 120 pounds or over were 0.05 cc. (50,000,000 bacilli), 0.1 cc. (100,000,000 bacilli) and 0.15 cc. (150,000,000 bacilli) in series. Fifty-four of the children in this subgroup were given the injections at two week intervals and the remaining 46 at three week intervals. In subgroup 3, composed of 106 children, the three intracutaneous inoculations given the children weighing 120 pounds or more consisted of 0.1 cc. (100,000,000 bacilli), 0.15 cc. (150,000,000 bacilli) and 0.2 cc. (200,000,000 bacilli) of the vaccine. In this subgroup 57 subjects were given the injections at two week intervals, while 49 received them at three week intervals. It should be remembered that in all of these subgroups the dosage varied with the weight, as was stated previously.

TABLE 1.—*Comparison of Systemic Reactions in Groups A and B* *

			Group B					
	Group A (Doses†: 0.5, 1 and 1 Cc.)		Subgroup 1 (Doses†: 0.05, 0.1 and 0.1 Cc.)		Subgroup 2 (Doses†: 0.05, 0.1 and 0.15 Cc.)		Subgroup 3 (Doses†: 0.1, 0.15 and 0.2 Cc.)	
Symptoms Following Injections	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Headache	32	3.7	2	0.7	1	0.3	4	1.2
Fever (temperature 99.6-104 F.)	21	2.4	0	0	0	0	0	0
Emesis	5	0.6	0	0	0	0	0	0
Chills	4	0.4	0	0	0	0	0	0
Abdominal pain	3	0.3	0	0	0	0	0	0
Nausea	3	0.3	0	0	0	0	2	0.6

* The patients in group A received subcutaneous injections and those in group B intradermal injections of typhoid vaccine.

† The doses indicated are the full adult doses, which were given to the subjects weighing 120 pounds (54.4 Kg.) or more. The children weighing less than 120 pounds received proportionately smaller doses, as is explained in the text.

Results.—GROUP A.—Of the 285 children who received the typhoid vaccine subcutaneously, 48 (16.8 per cent) had some systemic reaction after at least one of the three injections. Most of the reactions followed the administration of the first dose. Twenty-nine (10.1 per cent) experienced a constitutional reaction to the first dose, 14 (4.9 per cent) had some systemic complaint after the second dose and 7 (2.4 per cent) complained of a generalized reaction after the third dose. Data on the systemic reactions are summarized in table 1.

The average local reaction measured 46 mm. in diameter. The complaint of a sore arm was elicited after 86 (10.0 per cent) of the 855 injections, and tender regional adenitis developed after 7 (0.8 per cent).

No significant difference in the subsequent agglutinin titer of the blood was observed whether the typhoid vaccine was administered at two or at three week intervals. No somatic, or O, agglutinin appeared in the blood of 103 (36.1 per cent) of the children, a titer of 20

developed in 5 (1.8 per cent), of 40 in 1 (0.3 per cent), of 80 in 6 (2.1 per cent) and of 160 in 170 (59.7 per cent). The flagellar, or H, agglutinin titer was negative for 1 (0.3 per cent) of the children, 320 for 4 (1.5 per cent), 640 for 262 (91.9 per cent) and 1,280 for 18 (6.3 per cent). A summary of the data on the agglutinin titers is given in table 2.

GROUP B.—Constitutional reactions were considerably less frequent in this group of 295 children who received the typhoid vaccine intradermally than in group A. Only 8 subjects (2.7 per cent) experienced any systemic reaction, and all of the reactions were mild. The majority (5) occurred among the subjects of subgroup 3 (table 1).

In subgroup 1, composed of 89 children, in which the three doses administered to the children weighing 120 pounds or over were 0.05,

TABLE 2.—*Comparison of Agglutinin Titers in Groups A and B One Month After Immunization*

	Group A		Group B					
			Subgroup 1		Subgroup 2		Subgroup 3	
Titers	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
O Agglutinins								
0	103	36.1	79	88.8	99	99	101	95.3
20	5	1.8	7	7.8	0	0	0	0
40	1	0.3	2	2.2	0	0	0	0
80	6	2.1	1	1.1	0	0	1	0.9
160	170	59.7	0	0	0	0	3	2.9
320	0	0	0	0	0	0	1	0.9
1,280	0	0	0	0	1	1	0	0
H Agglutinins								
0	1	0.3	0	0	1	1	0	0
320	4	1.5	8	9.0	0	0	0	0
640	262	91.9	79	88.8	98	98	105	99.1
1,280	18	6.3	2	2.2	1	1	1	0.9

0.1 and 0.1 cc., the average local reaction was 26 mm. in diameter. The complaint of a sore arm was elicited after 3 (1.1 per cent) of the 267 injections. The O agglutinin did not appear in the blood of 79 (88.8 per cent) of the subjects, reached a titer of 20 for 7 (7.8 per cent), of 40 for 2 (2.2 per cent) and of 80 for 1 (1.1 per cent). The H agglutinin titer rose to 320 for 8 (9.0 per cent) of the children, to 640 for 79 (88.8 per cent) and to 1,280 for 2 (2.2 per cent). The difference in the interval between injections did not alter the agglutinin response.

In subgroup 2, composed of 100 children, in which the three intradermal doses given the children weighing 120 pounds or more were 0.05, 0.1 and 0.15 cc., the average local reaction was 29 mm. in diameter. A painful arm was complained of after only 1 (0.3 per cent) of the 300 injections. Postimmunization Welch-Stuart tests revealed no O agglutinins for 99 (99 per cent) of the children and a titer of 1,280 for 1 (1.0 per cent). The H agglutinin titer was negative for 1

(1.0 per cent) of the children, 640 for 98 (98 per cent) and 1,280 for 1 (1.0 per cent). Again no statistically significant difference in the agglutinin titer was found whether the interval between injections was two or three weeks.

In subgroup 3, composed of 106 children, the subjects weighing 120 pounds or over received three doses of typhoid vaccine, consisting of 0.1, 0.15 and 0.2 cc. The average local reaction was 35 mm. in diameter. A painful arm was complained of after 4 (1.2 per cent) of the 318 injections, and tender regional adenitis was found after 2 (0.6 per cent). One month after immunization the O agglutinin titer was negative for 101 (95.3 per cent) of the children, 80 for 1 (0.9 per cent), 160 for 3 (2.9 per cent) and 320 for 1 (0.9 per cent). The H agglutinin titer, on the other hand, rose to 640 for 105 (99.1 per cent) of the subjects, and for 1 (0.9 per cent) it rose to 1,280. As in the other subgroups, the difference in the interval between injections did not affect the agglutinin titer.

COMMENT

With the intracutaneous method of immunization against typhoid fever the constitutional reactions produced were milder and far less frequent than those which followed the subcutaneous administration of the vaccine to a similar group of children. One of us in studying an older age group, 62 freshman medical students, found that a similar reduction in systemic reactions resulted when the intracutaneous route was employed. It is this difference in reactions that renders the intradermal method superior to the subcutaneous method for typhoid immunization. Intracutaneous administration to children weighing 120 pounds or more of three doses of vaccine, consisting of 0.05 cc. (50,000,000 bacilli), 0.1 cc. (100,000,000 bacilli) and 0.15 cc. (150,000,000 bacilli) produced practically no constitutional reactions; however, the comparable intradermal administration of three doses of 0.1, 0.15 and 0.2 cc. did cause occasional systemic reactions.

The local reactions were considerably less annoying when the intradermal method was employed.

The length of the interval (both two and three weeks were used) between injections did not alter the agglutinin response significantly. The production of somatic, or O, agglutinins was not stimulated to any marked degree by the intradermal injection of typhoid vaccine, whereas after subcutaneous inoculation a moderate response developed in almost two thirds of the subjects. Intradermal administration to the children weighing 120 pounds or more of three doses of 0.05, 0.1 and 0.15 cc. (subgroup 2) or 0.1, 0.15 and 0.2 cc. (subgroup 3) of vaccine increased the flagellar or H, agglutinin titers to levels about as high as those obtained by the subcutaneous method. Thus, confirming

other reports, we found that the intradermal method of typhoid vaccination produced an adequate H agglutinin response, but we did not find as high O agglutinin titers as Tuft [7] and Perry [10] reported. It would have been desirable to check the protective power of the blood of the subjects by means of mouse protection tests, but we were not able to perform them in this study. Nevertheless, the presence of agglutinins in the blood serum indicates a certain degree of immunity.

Despite the lack of stimulation of production of the O agglutinins by the intradermal method, we believe that this method of typhoid vaccination is satisfactory, because reactions are practically eliminated and the difference between the agglutinin titers produced and those obtained with the subcutaneous method does not seem highly significant. For intradermal administration the three doses for subjects weighing 120 pounds or over which are apparently the most satisfactory are 0.05, 0.1 and 0.15 cc. in series, because with this dosage the reactions are minimal and there is no significant lowering of the subsequent agglutinin titers.

SUMMARY AND CONCLUSIONS

The intradermal and the subcutaneous method of typhoid vaccination were compared in a study of 580 children ranging in age from 1.5 to 19 years.

Reactions, both local and general, are much reduced in frequency and severity when the intradermal method is employed.

Whether the interval between the injections of typhoid vaccine is two weeks or three weeks does not alter the subsequent agglutinin titer.

Vaccination by the intradermal route produces as high an H agglutinin titer as that obtained by the subcutaneous route; the increase in the O agglutinin titer, however, is less than that obtained by the subcutaneous method.

For intradermal administration three doses of 0.05 cc. (50,000,000 bacilli), 0.1 cc. (100,000,000 bacilli) and 0.15 cc. (150,000,000 bacilli) of typhoid vaccine for subjects weighing 120 pounds or over (with corresponding reduction in dosage for those weighing less) are the most satisfactory, since reactions are minimal and there is no significant reduction in the agglutinin response.

Miss Phyllis Hickman performed the Welch-Stuart tests. Lederle Laboratories, Inc., of New York, supplied the antigen for the Welch-Stuart tests performed in this study.

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10. Perry, R. M.: Comparison on Typhoid "O" and "H" Agglutinin Response Following Intracutaneous and Subcutaneous Inoculation of Typhoid, Paratyphoid A and B Vaccine, Am. J. Hyg. **26**:388 (Sept.) 1937.

VAGINAL FLORA IN CHILDREN

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During recent years, some observations respecting vaginal infections in children attending the Vanderbilt Clinic suggested that there was a decreasing incidence of the gonococcus as an etiologic agent. A number of recorded studies in other localities supported this belief. Some investigators, however, have expressed the belief that the gonococcus is still the usual cause of vaginal discharge.[1] Therefore the present study was designed to determine what agent, or agents, is responsible for the production of this symptom in girls and at the same time to investigate the possible relation of vaginal discharge and the occurrence of infections of the upper respiratory tract. It also seemed desirable to obtain some information concerning the bacterial inhabitants of the healthy vaginal tract. This report consists, then, for the most part, in a record of data on smears and cultures and the clinical status for 16 premature infants studied in the nursery of Sloane Hospital for Women, for an unselected group of 81 children observed in the wards of the Babies Hospital and for 93 children with vaginal discharge who during an interrupted period of eighteen months, from May 1939 to October 1940, were referred to my associates and me from the pediatric section of the Vanderbilt Clinic.

METHODS

Premature Infants.—Premature infants rather than full term babies were chosen to represent the newborn group because of their longer period of care in the hospital nursery. Material for smears and cultures was obtained from the subjects at irregular intervals, commencing eight hours after birth and continuing up to the age of 3 months. Vaginal secretions were collected by means of a sterile glass catheter dipped in solution of sodium chloride. Each examination was planned to include the study of (1) a Gram-stained smear, (2) an iodine-stained smear and (3) a culture on at least one plain blood agar plate incubated aerobically. These preparations were supplemented on occasion by smears stained with the Giemsa and the nigrosin methods and by cultures made on other mediums and with other methods of incubation. The approximate hydrogen ion concentration of the vaginal secretion was determined in a number of cases by the use of nitrazine paper. The

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1. Schauffler, G. C.: Pelvic Peritonitis in Female Infants and Children, Surg., Gynec. & Obst. **71**:286-293 (Sept.) 1940.

Gram stain served to differentiate epithelial cells, leukocytes and bacteria. The iodine stain (a half and half mixture of compound solution of iodine U. S. P. and glycerin) revealed the intracellular glycogen. The Giemsa and nigrosin stains showed the bodies or granules which have been called inclusion bodies by some investigators.

Older Hospitalized Patients.—The plan of study followed for the older children in the hospital wards was similar to that used for the premature infants. An additional culture plate of MacConkey's medium was used, and a number of lysozyme determinations were made. Material for these determinations was collected as follows: A small sterile cotton tampon, tied to a black silk thread, was gently pushed into the vagina through a narrow open glass tube. The tube was removed and the thread fastened by means of adhesive tape to the child's thigh. After seven hours the tampon was removed, and lysozyme activity in the fluid pressed from it was determined by observation of its lytic effect when incubated with standard suspensions of Micrococcus lysodeikticus.[2]

Clinic Patients.—The work with the clinic patients was more detailed. Because of our interest in a possible relation between infections of the upper respiratory tract and of the vagina, the taking of the history, the clinical examination and the bacteriologic studies were directed toward an elucidation of such an association. In addition to the hanging drop preparations, it was planned to prepare each culture on (1) a chocolate buffered agar plate, (2) a plain blood agar plate and (3) a plate of MacConkey's medium. The first plate was incubated invariably in an atmosphere of 8 to 10 per cent carbon dioxide.[3] Observations on the various organisms encountered on such plates led us finally to use this method of incubation as far as possible for all original cultures. In the laboratory we endeavored to identify the organisms observed as completely as possible. For many patients, cultures of material from the posterior portion of the nasal cavity or from the oral pharynx or from both areas were prepared on plain blood agar plates; they were usually incubated in air. For the grouping of the hemolytic streptococci which were isolated, Fuller [4] extracts were prepared.

We had speculated concerning the presence of the virus of inclusion blennorrhea in the vagina of the child, and a number of the patients of the clinic group were examined with this speculation in mind.

An applicator saturated with 0.5 per cent solution of pontocaine hydrochloride was inserted into the child's vagina and allowed to remain there for a few moments. Then, by means of a small speculum and a platinum spatula, some epithelial scrapings were obtained for staining by the Giemsa method. An ordinary dry cotton-tipped applicator was then inserted, rubbed rather vigorously over the epithelium and set aside for inoculation of the conjunctival sac of a baboon.

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2. Thompson, R.: Lysozyme and Its Relation to the Antibacterial Properties of Various Tissues and Secretions, Arch. Path. **30**:1096-1134 (Nov.) 1940.

3. Leahy, A. D., and Carpenter, C. M.: Diagnosis of Gonococcal Infections by Cultural Method, Am. J. Syph., Gonor. & Ven. Dis. **20**:347-363 (July, pt. 1) 1936. Malcolm, M. M., and Dolman, C. E.: Gonococcus Culturing in Public Health Laboratory Practice, Canad. Pub. Health J. **30**:252-259 (May) 1939.

4. Fuller, A. T.: The Formamide Method for the Extraction of Polysaccharides from Haemolytic Streptococci, Brit. J. Exper. Path. **19**:130-139 (April) 1938. Butler, H. M.: The Precipitin Test Applied to Melbourne Hemolytic Streptococci, M. J. Australia **2**:501-509 (Sept. 24) 1938.

RESULTS

Bacteriologic Observations.—At birth the vaginal canal is packed with desquamated epithelial cells. A suspension of these cells in physiologic solution of sodium chloride has a p_H somewhat below 5. The cells are for the most part well filled with glycogen, but some of them appear to be in a state of disintegration, due no doubt to the presence of enzymes.[5] Within a few hours the exudate becomes somewhat thinner, and as early as twelve hours after birth some bacteria may appear in the smear. We have found that these first bacteria are gram-positive cocci. A culture at this time may be sterile. From twenty-four hours after birth onward bacteria appear in smears and cultures in great profusion, and after the third and fourth days there are many leukocytes in the smears. After the second week the unusual growth of bacteria is gradually reduced. Superficial cells continue to be sloughed in great abundance, and some cells from the deeper layers may appear when leukocytes are most numerous. There is considerable individual variation in the duration of this phenomenon. In many cases even after three months there is definitely more epithelial desquamation than, for example, at 2 years of age.

As the tissues mature cellular activity is much reduced, and in many cases bacteria scarcely seem to multiply at all. Smears from the first year on may show nothing but an isolated superficial epithelial cell with perhaps two or three organisms near it; sometimes there may be in addition one or two cells from deeper layers on the slide, with or without traces of glycogen. The p_H of such a vaginal washing is approximately 7; a culture of it may show a single colony or several. Such a normal course of events is rare for hospital inmates. We usually found, even when there was no outward sign of inflammation, a turbid fluid on catheterization, a spread of epithelial cells from deep, middle or superficial layers, moderate numbers of leukocytes and bacteria and plentiful growths of organisms on culture. Occasionally, again with no discharge or outward sign of inflammation, on withdrawing the catheter we found it filled with frank pus. One of the premature infants had a continuous copious purulent discharge from the second to the sixth week after birth; a beta hemolytic streptococcus (not classified further) and a pathogenic staphylococcus [6] persisted during this time in the vaginal exudate.

Lysozyme was demonstrated in the vaginal washings in 16 cases, with considerable quantitative variation.

5. Cruickshank, R., and Sharman, A.: Biology of Vagina in the Human Subject: Glycogen in Vaginal Epithelium and Its Relation to Ovarian Activity, J. Obst. & Gynaec. Brit. Emp. **41**:190-207 (April) 1934.

6. Blair, J. E.: Pathogenic Staphylococci, Bact. Rev. **3**:97-146 (June) 1939.

The bacteria recovered from the cultures of material from the vagina for all the groups of patients are listed in table 1. For the purpose of analysis these cultures are divided into two groups: (1) those for patients who had a purulent exudate, as revealed by study of a smear made at the time the material for culture was taken, and (2) those for patients in whose smears not more than a few leukocytes were found. The results of 52 cultures were disregarded in the preparation of this table because they were unaccompanied by a satisfactory study of a

TABLE 1.—*Organisms Isolated in All Cultures as Related to Nature of Accompanying Exudate*

	Many Leukocytes in Smears					Rare Leukocytes or None in Smears				
	Clinic Patients	Hospital Patients	Premature Infants	Total	Percentage	Clinic Patients	Hospital Patients	Premature Infants	Total	Percentage
Total number of cultures	257	47	39	343		77	34	18	129	
Number of cultures containing:										
Diphtheroids	214	32	28	274	80	57	19	12	88	60
Staphylococcus albus	213	33	30	266	77	54	16	10	80	60
Staphylococcus aureus	23	6	2	31	9	9	6	1	16	13
Staphylococcus aureus (pathogenic)	13	5	3	21	6	5	2	0	7	5
Staphylococcus citreus	8	2	1	11	3	1	2	1	4	3
Sarcina	13	6	3	22	7	3	3	0	6	5
Streptococcus indifferens	80	14	21	115	33	36	12	15	63	50
Streptococcus haemolyticus (no hemolysis in blood broth)	62	16	0	78	23	11	10	0	21	6
Streptococcus haemolyticus (hemolysis in blood broth)	15	2	2	19	5	2	3	0	5	4
Streptococcus, group A	27	1	0	28	9	0	2	0	2	1
Escherichia coli	82	20	30	132	38	20	13	14	47	36
Paracolon bacilli	8	1	0	9	3	6	2	0	8	6
Diplobacilli	14	0	0	14	4	0	0	0	0	0
Diplobacilli (anaerobic)	0	0	3	3	0	0	0	0	0	0
Other gram-negative rods	11	5	0	16	5	2	9	0	11	8
Anaerobic streptococcus	0	0	2	2	0	0	0	0	0	0
Haemophilus influenzae	5	0	0	5	2	1	1	0	2	2
Pneumococcus	0	0	0	0	0	0	1	0	1	1
Bacillus döderleini	4	2	1	7	2	25	2	1	28	22
Gonococcus	22	0	0	22	7	0	0	0	0	0
Other gram-negative cocci	2	0	1	3	0	2	0	0	2	2
Yeasts	0	1	0	1	0	2	0	0	2	2
Bacillus subtilis	3	0	1	4	1	1	1	0	2	2
Number of sterile cultures	0	1	0	1	0	0	1	1	2	1

smear. From a perusal of this table one deduces that the presence of gonococci or diplobacilli is always associated with inflammation. The same tends to be true of two classes of streptococci as well, those which belong to group A and those which are listed as "Streptococcus haemolyticus (no hemolysis in blood broth)." The latter organisms bore no cultural resemblance or serolgoic relation to the streptococci of groups A, B or C.

Streptococci of group A were isolated from the vagina 28 times in a total of 12 cases. They were found in 16 of 71 cultures of material from the nose and in 4 of 37 cultures of material from the throat. Their colonies were of two types, a pearly white, smooth-edged variety which

seemed somewhat granular when touched with the needle and a very dry angular colony with borders which curled after twenty-four hours' growth. Almost all produced very granular growths in broth. Similar organisms were cultured also from material from 2 normal vaginas; in 1 case the growth consisted of just 6 colonies, and in the other the colonies were abundant. In one culture, for a child who received sulfanilamide, only 5 colonies grew. Four of these showed the hemolysis typical of beta hemolytic streptococci on the plate and hemolysis in blood broth; one showed no hemolysis on the plate or in blood broth. Both forms were of group A, and both, in vitro, were equally susceptible to sulfanilamide. Eleven representatives of group B streptococci were isolated from the cultures of material from the vagina, 1 of which was recovered from a culture for a patient who also carried organisms of group A, and 1 representative of group C. There were 14 strains which showed hemolysis in blood broth but which did not fall into any of these three groups.

The gram-negative cocci, other than gonococci, isolated were of the Neisseria pharyngis group and showed pigment production.

Among the gram-negative rods, other than those listed in the table, were 15 strains of paracolon bacilli, 7 of Shigella, 3 of Salmonella, 5 of Alcaligenes faecalis, 1 variety of Bacillus proteus and 9 unclassified types.

In 1 case a paracolon organism was isolated 15 times from the vagina in the course of a year. A similar organism was recovered from a specimen of urine obtained by catheterization. The blood serum in this case agglutinated the vaginal organism in a dilution of 1 to 2,560.

The one yeast isolated from a hospitalized patient was Monilia albicans,[7] but there was no external sign of inflammation.

Bacillus döderleini occurred in those cases in which there were many superficial epithelial cells in smears and, sometimes, many leukocytes as well.

By means of the hanging drop we recognized trichomonas in 2 cases, repeatedly. In 1 of these cases the gonococcus also was isolated; in 2 cultures in the other, colonies suspected of being gonococci were not positively identified. In studying these preparations we had in mind the possibility of the occurrence of other parasites or ova. We saw 1 child in a drop of whose vaginal washing we discovered one pinworm; yet she had no discharge or other sign of irritation.

The diplobacilli, some strains at least of Haemophilus influenzae and a diphtheroid organism may produce a positive oxidase reaction, we found. The first-mentioned organisms may be really con-

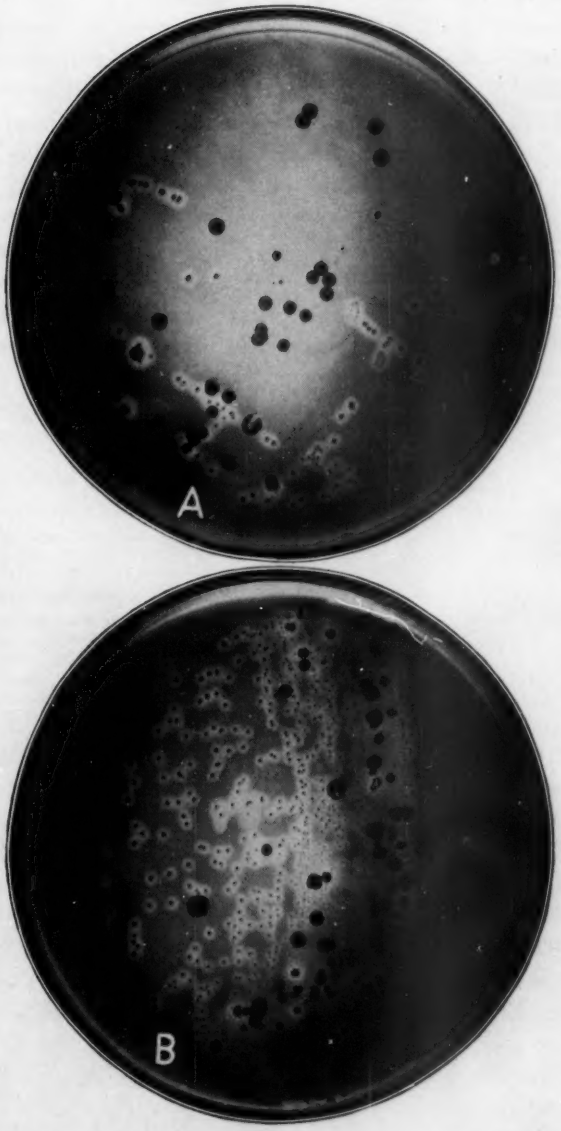
7. Benham, R. W.: Certain Monilias Parasitic on Man: Their Identification by Morphology and by Agglutination, J. Infect. Dis. **49**:183-215 (Sept.) 1931.

fusing, for when they are growing in mixed culture the colonies are very like those of the gonococcus; also, on solid mediums the organism is frequently of coccoid form. On subculture, however, it grows on plain mediums in air, albeit slowly, and it does not ferment any of the common carbohydrates.

The results of all of the cultures of material from the nose and throat have not been tabulated, since we were interested in them only in relation to corresponding cultures of material from the vagina. Table 3 presents convincing evidence from 10 cases of an interrelation of infections of the upper respiratory tract and the genital tract. There is also suggestive evidence from many histories that the vaginitis was a complication of or a sequel to an infection of the respiratory tract. Throughout the study there was manifest a closer bacteriologic connection between nose and vagina than between throat and vagina; the similarity in the culture plates of material from the two areas was often striking (figure). Two patients, J. W. and T. M., after a temporary quiescence of symptoms referable to the vagina, suffered a recurrence associated with an infection of the upper respiratory tract; H. influenzae was found abundantly in the cultures of material from the vagina in both cases at this time and also in the culture of material from the nose in 1 case. Three other patients carried this organism concurrently in both areas. Another patient, with a history of prolonged dietary deficiency, showed numerous colonies of Corynebacterium pseudodiphtheriae in cultures of material from both the nose and the vagina. A pathogenic staphylococcus was found in concurrent cultures of material from the nose and the vagina of 4 patients.

No inclusion or elementary bodies suggestive of a virus infection were discovered in any of the Giemsa-stained preparations. Sixty-six inoculations of the conjunctival sacs of baboons were made with material from 52 patients. Of these, 2 gave positive results, that is, follicular conjunctivitis was evident ten days after inoculation. From such follicles in the baboon it is notoriously difficult to recover inclusion bodies; nevertheless, in a series of 8 slides of scrapings from the first infected eye, a single typical inclusion body was found. The 2 positive results were for the same patient and were obtained two weeks apart. A third inoculation, again after an interval of two weeks, gave negative results. This particular patient, a mature child of 10 years, had had a vaginal discharge intermittently since the age of 2. It cleared up, and she remained free of it for two months during her course of visits to the clinic after the use of silver picrate suppositories. Cultural studies had revealed no specific bacterial agent.

Clinical Observations.—Among the 93 patients attending the clinic were 10 whose discharge was found to be nonpurulent. Their ages lay between 9 and 13 years. Seven had no symptoms other than discharge,



Blood agar plates of cultures of material taken from the nose (*A*) and the vagina (*B*) of patient A. H. on Dec. 26, 1939 (table 3).

2 complained of occasional chafing and 1 had urinary frequency and nocturia. Table 2 summarizes our observations on the members of this group. Vaginoscopic studies on these patients revealed noteworthy pathologic signs in only 2. The 1 patient with urinary symptoms two years previously had experienced acute vaginitis of undetermined cause; the posterior lip of the cervix now showed considerable injection. Another patient persistently had an acid nonpurulent secretion free of trichomonas and pathogenic bacteria; yet vaginoscopic examination revealed two punctate hemorrhages on the cervix. There was no history of previous signs or symptoms to suggest any pathologic condition.

In this same age group were 4 patients with mild symptoms other than discharge whose smears showed, intermittently at least, many leukocytes. In cultures for 2 of these patients a pathogenic staphylococcus was found; 1 of them harbored an identical staphylococcus in the

TABLE 2.—*Results of Studies on Ten Patients with Nonpurulent Discharge*

	Number of Studies	Number of Patients	Results
Hanging drop cultures..	13	9	No trichomonas were found
Gram-stained smears....	20	10	Many superficial cells; very few leukocytes or none; B. döderleini appeared 19 times
Iodine-stained smears...	16	10	Much intracellular glycogen
Cultures.....	20	10	B. döderleini recovered 17 times; colonies of yeast recovered in 2 cultures for 1 patient
Determinations of p_H....	18	10	Below 5 17 times; below 6 once

nose. A second patient in this group, who had a history of repeated sore throat and signs of maxillary sinusitis, showed no pathogenic organism in the one culture of material from the vagina made at the time of the original incident. She had symptoms of dysuria; vaginoscopic examination revealed injected vaginal walls and an eroded cervix. Two months after treatment of the sinusitis the smears showed only a rare leukocyte and many superficial epithelial cells containing glycogen; B. döderleini was recovered on culture.

Very few patients were seen early in the course of the disease; only 1 came to us with a marked febrile reaction (S. B., table 3), and in her case a type 25 streptococcus was the etiologic agent. She had at the time a severe infection of the upper respiratory tract and diarrhea. In most cases there was a history of sudden appearance of profuse discharge attended by no other or by some urinary symptom. Frequently the onset was insidious. The most common symptoms were due to local external irritation; chafing, itching, soreness or pain on walking was mentioned 40 times for all 93 patients. Nocturia occurred 7 times; dysuria, 17; enuresis, during the day, the night or both, 7; urinary

frequency, 10; urinary urgency, 3, and difficulty in beginning micturition, 1. The various urinary symptoms tended to disappear early in the course of the illness, leaving no complaint except discharge. Other symptoms mentioned were abdominal pain, in 8 cases; anorexia, in 8; headache, in 2; irritability, in 4; fever, in 2; nervousness, in 2, and fatigue, in 3. Signs of inflammation of the urethra were infrequent; a pouting urethral orifice was observed 3 times, edema 6 and simple injection 14. On 2 occasions the openings of Skene's glands were unusually prominent, but culture of material from these areas yielded only the same organisms that were found in the vagina. The 91 vaginoscopic examinations performed on 58 patients revealed frequent cervical involvement. Inflammatory redness was found 30 times, erosion 6 times, punctate hemorrhage 4 times and exudate from the external os 12 times. Congestion of the superior vaginal wall was noted 29 times, denudation of the epithelium 4 times and congestion of the lower part of the vaginal tract 20 times.

The infections which were due to the gonococcus showed no very marked clinical differences from those due to the streptococcus except that the latter were perhaps a trifle more acute in onset. Two of the patients with streptococcic infections had inguinal glands which were not only palpable but tender and painful, and 1 child had painful cervical adenitis as well. Table 3 gives data for the 10 cases in which the streptococcic vaginal infection was proved to be related to an infection of the upper respiratory tract. From the history in 8 of these cases one might have surmised that the two manifestations of infection were related. However, the 3 youngest of the patients with gonorrhea, whose histories extended only over six, ten and fourteen days respectively, came to us also with a severe infection of the respiratory tract. In 1 case diplobacilli were recovered from cultures of material from the nose, the conjunctival sac and the vagina; in the culture of material from the vagina, the number of colonies of this organism was small in comparison with that of the gonococcus.

Treatment.—In the beginning of our work, silver picrate vaginal suppositories [8] (1 grain in a boroglyceride gelatin base) were prescribed for all types of infection.[9] A total of 284 suppositories was used for 26

8. The silver picrate suppositories were supplied by John Wyeth & Brother, Inc.

9. Holmes, J. W.; Jones, J. A., and Gildersleeve, N.: The Treatment of Gonorrheal Vulvo-Vaginitis in Children with Silver Picrate Suppositories, J. Pediat. **15**:86-90 (July) 1939. Golub, L. J., and Shelanski, H. A.: Silver Picrate Treatment of Vaginal Trichomoniasis, J. Lab. & Clin. Med. **22**:1155-1160 (Aug.) 1937. Kobak, A. J., and Frankenthal, L. E.: Treatment of Cervicovaginitis in Children with Silver Picrate Suppositories, Am. J. Obst. & Gynec. **34**:292-298 (Aug.) 1937.

patients, 4 of whom owed their infections to the gonococcus, 1 to a group A streptococcus and 21 to apparently nonspecific causes. None of the 4 patients with gonorrhea showed symptomatic or bacteriologic

TABLE 3.—*Data for Patients with Streptococcic Infection*

	Date	Source of Material for Culture *	Organism Recovered
Patient R. S.	6/17/40	V	Streptococcus, group A
	6/25/40	V	Streptococcus, group A
	6/25/40	N	Streptococcus, group A
	7/30/40	N	Streptococcus, group A
Patient A. H.	12/12/39	V	Streptococcus, group A, type 28
	12/26/39	V	Streptococcus, group A, type 28, and Staph. aureus, mannitol positive
	12/26/39	N	Streptococcus, group A, type 28
	12/26/39	N	Staph. aureus, mannite positive
	1/ 9/40	V	Streptococcus, beta hemolytic
	1/ 9/40	N	Streptococcus, beta hemolytic
Patient C. T.	12/ 2/39	V	Streptococcus, group A, not typed
	1/ 2/40	V	Staph. aureus, coagulase positive
	1/ 2/40	N	Staph. aureus, coagulase positive and Streptococcus, group A, type 28 (?)
	1/ 9/40	V	Streptococcus, group A, type 11
	1/ 9/40	N	Streptococcus, group A, type 11
	2/27/40	V	Staph. aureus, mannite positive
	2/27/40	N	Staph. aureus, mannite positive
Patient R. C.	6/25/40	V	H. influenzae
	7/ 9/40	V	Streptococcus, group A
	7/ 9/40	N	Streptococcus, group A
Patient J. W.	2/27/40	V	Streptococcus, group A, type 24 (?)
	3/12/40	N	Streptococcus, group A, type 24
	4/30/40	V	H. influenzae
	4/30/40	N	H. influenzae
Patient S. B.	3/ 5/40	V	Streptococcus, group A, type 25
	3/ 5/40	N	Streptococcus, group A, type 25
	3/12/40	V	Streptococcus, group A, type 25
	3/12/40	N	Streptococcus, group A, type 25
	3/19/40	V	Streptococcus, beta hemolytic
	4/ 3/40	N	Streptococcus, group A
Patient D. H.	6/ 1/40	V	Streptococcus, group A
	6/28/40	V	Streptococcus, group A
	6/28/40	N	Streptococcus, group A
Patient G. C.	7/ 9/40	V	Streptococcus, group A
	7/ 9/40	N	Streptococcus, group A
	7/ 9/40	T	Streptococcus, group A
	7/16/40	T	Streptococcus, group A
Patient C. M.	7/ 9/40	V	Streptococcus, group A
	7/16/40	V	Streptococcus, group A
	7/16/40	N	Streptococcus, group A
Patient C. R.	4/ 2/40	V	Streptococcus, group A
	4/ 9/40	V	Streptococcus, group A
	4/ 9/40	N	H. influenzae
	4/16/40	V	Streptococcus, group A
	6/28/40	V	H. influenzae
	6/28/40	N	H. influenzae and streptococcus, like organisms of group A

* V signifies vagina, N nose and T throat.

improvement, even though as many as 30 suppositories were used in 1 case over a period of five weeks. The 1 patient with a streptococcic infection showed an increase of local symptoms during a course of treatment in which 6 suppositories were used, and no improvement was noted afterward. Among the 21 patients with infections with no specific cause were 5 who were cured after a total of 82 suppositories had

been used. The infections of 4 of these 5 patients had continued for more than one year; the illness of 1 was of brief duration. The criteria for cure consisted of a prompt reduction in the symptoms and in the numbers of leukocytes in the smears and of bacteria in the cultures, together with freedom from discharge and from signs of inflammation for at least one month after the termination of treatment. Eight patients showed some irritation from the specific medication; of these, 3 complained of local burning, 3 of suprapubic pain after use of the suppository, 1 of local irritation followed by a generalized erythematous eruption and 1, who had some previous urinary symptoms, of an increase in urgency and frequency of micturition.

Because of the large numbers of gram-positive cocci (staphylococci and green-producing and indifferent streptococci) found in cultures for the patients with nonspecific infections, it was thought that instillations of gentian violet might be of value. Instillations of 2 per cent aqueous solution of gentian violet were used in 2 cases with some benefit. Another patient first came to us five months after the beginning of her infection, which had been characterized by an acute onset and an acute flare-up two months later. During the following seven months, although she was not continuously under our care, she received a variety of treatments, including the use of silver picrate suppositories, 4 instillations of 8 per cent aqueous solution of gentian violet and a few instillations of 10 per cent solution of mild protein silver (solargentum). Three and a half months later, when she returned to us for consultation, an attempt at vaginoscopic examination revealed an obstruction by fibrous tissue 1 inch (2.5 cm.) above the introitus.[10]

Sulfanilamide was used for the gonococcic and the more severe of the streptococcic infections. Treatment was begun with 1 grain per pound (0.06 Gm. per 0.5 Kg.) of body weight given in divided portions for the first twenty-four hours, and the dose was gradually reduced. Since the patients were not under constant supervision, the treatment was frequently interrupted or prematurely discontinued. To test the response in the cases of gonococcic infection, the patients were requested to return for repeated culture after the first culture negative for gonococci was obtained, at 3 weekly intervals, at 4 fortnightly intervals and at 3 monthly intervals. If clinical signs disappeared and the last 7 consecutive cultures were negative, we considered the patient cured. Data and results for the cases of gonococcic infection were as follows:

C. B., 8 years old, had been treated for one month with amniotin suppositories before coming to our clinic. Two weeks after cessation of this treatment she suffered an acute recurrence, and some months later she came to us. Cultures

10. Meyer, R.: Zur Aetiologie der Gynatresien auf Grund der einschlägigen Casuistik, Ztschr. f. Geburtsh. u. Gynäk. **34**:456-518, 1896.

of the vaginal discharge yielded the gonococcus. We gave her sulfanilamide for twelve days. Clinical cure resulted, and during the following four months the 7 cultures obtained were negative for gonococci.

B. R., 8 years old, came to us two months after the initiation of symptoms. The use of 6 silver picrate suppositories failed to result in a culture negative for gonococci, and we gave her sulfanilamide for eight days. She was followed up for ten months, during which time we obtained 9 negative cultures. Her mother reported that there was always a recurrence of discharge after the child had attended dancing class; yet cultures of material taken at the regular visit to the clinic, three days after each class, were always negative, and the symptoms ceased when the special exercise was given up.

R. L., 4 years old, came to the clinic five weeks after the beginning of her infection. Sulfanilamide was given for four days. Clinical cure resulted, and she had 5 cultures negative for gonococci during the following six weeks.

T. D., 3 years old, came to us two weeks after the onset of symptoms. We used silver picrate suppositories unsuccessfully for three weeks. Sulfanilamide was then given for four days. Clinical cure followed, and we obtained 5 cultures negative for gonococci over the following six months.

T. M., 9 years old, came to us with the history of a brief illness; but trichomonads as well as gonococci were present in the discharge. Thirty silver picrate suppositories failed to produce a culture negative for the offending organisms. Sulfanilamide was given for fourteen days. This was followed by 9 cultures negative for gonococci during the succeeding six and one-half months, although the discharge and the trichomonads in it persisted.

In the sixth case administration of sulfanilamide for six days produced no beneficial results.

In 6 of the cases of streptococcic infection also sulfanilamide was given, again for variable periods. In all 6 cases the infection cleared up satisfactorily, although in 2 the symptoms recurred mildly during the next infection of the respiratory tract. One of the 12 patients who received the drug had mild urticaria during the first week of administration, and another showed some swelling of the hands after small doses had been continued for one month, but the urine showed nothing abnormal. In several cases mild leukopenia occurred.

We made a limited trial of stilbestrol suppositories,[11] which contained 0.02 mg. of diethylstilbestrol in a boroglyceride gelatin base, in a total of 10 cases. The effect was to increase the number of superficial cells in smears as well as the amount of glycogen they contained and, in 3 cases, to lower the p_H markedly. In 1 case the use of 7 suppositories over a period of two weeks was sufficient to produce marked growth of the genitalia and the usual change in smears and p_H. In a case of acute streptococcic infection the use of 8 suppositories during two weeks before other treatment was used failed to reduce the inflammatory exudate, abolish the responsible streptococcus or lower the p_H. We found stilbestrol most useful as an adjunct after sulfanilamide had

11. The stilbestrol suppositories used were supplied by the Winthrop Chemical Co.

produced its characteristic bacteriostatic effect. In 9 cases there were no adverse symptoms (such symptoms were especially inquired about), but 1 child became nauseated during a course of treatment in which 6 suppositories were used over a period of two weeks.

COMMENT

Our studies of the premature infants supplied some information concerning the "genital crisis of the newborn" referred to by German writers.[12] No adequate explanation has been offered for the prolongation over many months of what is regarded to be the influence of the maternal estrogen. The abundance of leukocytes found in the discharge during the early weeks of life, even without other signs of inflammation, seems to represent a reaction to the numerous organisms present, even though these are usually nonpathogenic. Perhaps the very disintegration of the many glycogen-containing cells provides an unusually good culture medium for many bacteria in spite of the relatively low *p*H therein. Perhaps there later appears some antibacterial factor which is operative in children with optimal health. The fact that lysozyme is present in leukocytes prevented us from discerning any significant variations in the quantity of this enzyme present in purulent and in nonpurulent vaginal washings. The granules found in the cells of such early smears appeared to be identical with those bodies which Broadhurst and associates[13] orginally described as occurring in superficial epithelial cells derived from the pharynx of young adults. Recently they have reported finding comparable granules in the cells of vaginal smears and have expressed the opinion that they are evidence of a virus infection.[14] In our experience these bodies are associated with signs of estrogenic activity, such as desquamation of epithelial cells and increased intracellular glycogen. Furthermore, they have been found in great numbers in the vaginal cells of the guinea pig during the proliferative phase of the estrus cycle. Therefore further investigation concerning their nature and significance is indicated.

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12. Alexiu, M., and Herrnberger, K.: Untersuchungen des Vaginalinhaltes bei Neugeborenen und Säuglingen, Zentralbl. f. Gynäk. **62**:9-15 (Jan. 1) 1938. Zaharescu-Karaman, N.; Alexiu, M., and Ursu, A.: Der Sexual-Scheidenzyklus der Neugeborenen während der "Genitalkrise," Arch. f. Gynäk. **165**:116-128, 1937. Herrnberger, K., and Horstmann, F. H.: Der Glycogengehalt des kindlichen Vaginalepithels und seine Veränderung nach Follikelhormongaben, ibid. **168**:451-458, 1939.

13. Broadhurst, J.; Liming, R. M.; MacLean, M. E., and Taylor, I.: Cytoplasmic Inclusion Bodies in the Human Throat, J. Infect. Dis. **58**:134-149 (March-April) 1936.

14. Broadhurst, J.; Ewing, R.; LeMoyne, M., and MacLean, E.: Incidence of Cytoplasmic Inclusion Bodies in Vaginal Smears, Am. J. Syph., Gonor. & Ven. Dis. **24**:651-656 (Sept.) 1940.

It was impossible to determine the initial cause of the infections of many of the children because of the long duration of symptoms before they came to us. Two of the children had had a discharge for eight years, many of them for five years and all but a very few for a period of months at least. It seemed not unreasonable to consider a virus as the cause of the infection in some cases. Inclusion bodies have been demonstrated, both by smear and by transfer of disease, in the cervical cells of mothers in whose infants inclusion blennorrhea has developed.[15] Elementary bodies have been found in the exudate from eyes so affected. Since such cells are not unlike those of the immature vagina, we considered the virus of inclusion blennorrhea as a possible agent. Our results do not suggest that it is often present in the vagina in childhood. The 1 patient in whom we did determine its presence was at puberty, and it is possible that the virus was carried in her mature cervical cells.

A relation between vaginal infections and those of the respiratory tract, whether caused by viruses or by bacteria, has been occasionally suggested in the literature. Braid[16] has reported a series of 184 cases, in 12 per cent of which the disease was "acute streptococcal vulvo-vaginitis." She stated: "Without exception acute vulvo-vaginitis due to haemolytic streptococcus occurred during the winter months, and was preceded by a week or ten days by an upper respiratory infection. . . . The streptococcus can be isolated from the tonsil and from the vagina." In 1938 a careful investigation of two large series of cases of vulvo-vaginitis was made in London.[17] In a discussion of the condition in this report one reads: "It may occur during the course of general acute infections, particularly pneumonia, and has also been observed in attacks of influenza and possibly in ordinary coryza. . . . It may be secondary to acute throat infections, most commonly streptococcal. . . . In haemolytic streptococcal infections the tendency to relapse may last for a considerable length of time." Reichert and associates,[18] in 1937, stated, "In the large majority of cases of nonspecific infection the condition was a secondary catarrhal infection, secondary usually to infection of the upper part of the respiratory tract. . . ." The results in 12 per cent of our cases definitely confirm these earlier observations.

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15. Thygeson, P., and Mengert, W. F.: Virus of Inclusion Conjunctivitis: Further Observations, Arch. Ophth. **15**:377-410 (March) 1936; Correction, ibid. **15**:734 (April) 1936.

16. Braid, F.: Vulvo-Vaginitis in Children, Clin. J. **66**:378-380 (Sept.) 1937.

17. Vulvo-Vaginitis in Children: Clinical and Administrative Aspects (Abridged Report of Departmental Committee, London County Council), Lancet **1**:960-965 (April 23) 1938; Brit. M. J. **1**:961-965 (April 30) 1938.

18. Reichert, J. L.; Epstein, I. M.; Jung, R., and Colwell, C. A.: Infection of the Lower Part of the Genital Tract in Girls, Am. J. Dis. Child. **54**:459-495 (Sept.) 1937.

That vaginal discharge is not necessarily a sign of an infectious process is indicated by the observations on 10 of the patients previously described. Ordinarily, perhaps, the condition of the 14 patients at puberty would have been diagnosed simply as leukorrhea. It is sometimes considered that all leukorrheas in virgins are due to Trichomonas, yet in adequate studies of our patients with leukorrhea that organism was found in only 1 case. Laboratory and clinical studies on the group with leukorrhea revealed considerable fundamental difference in superficially similar conditions. The lack of leukocytes in smears of the secretions in many cases and the absence of clinical signs of inflammation lead one to believe that in some cases leukorrhea may be physiologic and unrelated to any pathogenic organism.

In the cases of infection the amount of purulent material exuding from the external os makes one suspect that the length of the tissue involved was greater than the 1 mm. which Benson and associates,[19] on the basis of their observations in a case of gonorrheal vaginitis, estimated to be the length of the canal of the ostium. Perhaps there is enough individual difference in the degree of development of cervical glands in young children to produce a variable pathologic picture. As the infection cleared, the cervix retained signs of inflammation longer than any other area. Indeed, we believe that the cervix regained a normal appearance only in those cases in which treatment with sulfanilamide was used.

We are aware of only two other references to the occurrence of diplobacilli in the vagina. One is a report of Williams and Styron,[20] published in 1933. In a careful bacteriologic study of cervicitis in a large number of adults they found 10 strains of a "cocco-bacillus," an organism which in all the aspects described is identical with the strains we have isolated. In 1 case it was considered responsible for the lesion. When it was inoculated into the peritoneums of guinea pigs, smears were obtained which were indistinguishable from those for patients in the acute stage of gonorrhea. Thompson,[21] also, in a note on the oxidase test, described a similar organism, but the variety he isolated differed in its sugar reactions from ours. Since this diplobacillus has been cultivated frequently from material obtained from the nose in the presence of chronic nasal disease, from the eye in cases of mild conjunctivitis and on 14 occasions from the vaginas of our patients we have at least some evidence for suggesting that it is responsible at times for a mild inflamma-

19. Benson, R. A.; Steer, A., and Speer, F. D.: Gonorrheal Vaginitis of Children, with Report of an Autopsy, Am. J. Dis. Child. **57**:291-305 (Feb.) 1939.

20. Williams, A. W., and Styron, N. C.: Specific Bacterial Cervicitis, Am. J. Obst. & Gynec. **25**:547-550 (April) 1933.

21. Thompson, L.: Other Oxydase Positive Bacteria Found in Cultures for Neisseria Gonorrheae, J. Bact. **31**:82-83 (Jan.) 1936.

tion and also for confusion in diagnosis by smear. Its incidence on healthy mucous membranes is not known. We have not cultivated it from material obtained either from a normal nose or from a normal vagina.

SUMMARY

In a study in which a limited attempt was made to ascertain the etiologic agents of vaginal infection in girls, the only bacteria which could be incriminated were the gonococcus, the group A streptococcus and, possibly, the diplobacillus of Petit.

In the case of the last two organisms, there is bacteriologic evidence, clinical evidence or both of an interrelation between infections of the upper respiratory tract and those of the genital tract.

This series included more cases of proved streptococcic than of gonococcic infections; yet, because of the long duration of the symptoms, no opinion can be offered as to the nature of the original etiologic agent.

The types of streptococcus found simultaneously in the upper respiratory and the vaginal tract were 11, 24, 25 and 28.

Further study of the diplobacillus, which, superficially at least, may be confused with the gonococcus, is indicated. Gonorrhea should not be diagnosed without complete cultural studies.

Among the patients studied very few, apart from the premature group, could be considered normal. The large number of purulent secretions found in the children in the hospital wards suggests that such a reaction may be the concomitant of a variety of illnesses or constitutional states. Saprophytic organisms appear to grow in the vaginas of such patients with little restraint. For information concerning normal vaginal flora of childhood we recommend study of a group of healthy girls.

More anatomic and histologic studies should provide a better understanding of vaginal infections, so that rational treatment could be devised. An attempt should be made, also, to give adequate clinical attention to patients with such infections as early in the course of the illness as possible.

INFLUENCE OF DIET ON THE URIC ACID EXCRETION OF YOUNG CHILDREN

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Investigators have given considerable study to the uric acid excretion of adults and to the allantoin excretion of animals, but there have been few such studies on children. In the course of three long time balance studies conducted at Michigan State College, considerable data were obtained concerning the uric acid excretion of preschool children.

Rose,[1] in his extensive review of the literature on purine metabolism, in 1923, clearly indicated that the uric acid excretion of man was not constant from day to day but that it varied with the proportions of protein, fat and carbohydrate in the diet. Protein, even that from purine-free sources, increased the elimination, while additional carbohydrate caused no increase unless the quantity was excessive. On the other hand, an increase in fat and also starvation produced decided decreases in the elimination.

Since 1923 other investigators have confirmed these general conclusions. The majority of the studies have been conducted on subjects with disease conditions, such as gout, or on patients with epilepsy or other conditions who were being treated with starvation and ketogenic diets. There have been no studies on preschool children.

The purpose of the present study was to determine the effect on the urinary uric acid excretion of young children of changes in the protein, the fat and the carbohydrate content of the diet.

EXPERIMENTAL PROCEDURE

During three long time balance studies conducted on preschool children, urinary uric acid determinations were made daily. In all three experiments, the children consumed a normal basal diet containing 3 Gm. of protein and 90 calories per kilogram for relatively long periods. After the basal diet, the children in the first two experiments received a diet containing 4 Gm. of protein per kilogram, while in the third experiment they had approximately a 20 per cent increase in calories. The figures for uric acid gave considerable information concerning the daily variation in excretion as well as data concerning the effects of increasing protein or calories.

From the Section of Home Economics, Michigan State College, Agricultural Experiment Station, paper no. 393, new series.

1. Rose, W. C.: Purine Metabolism, Physiol. Rev. **3**:544-602 (Oct.) 1923.

The purpose of the first two experiments was to determine the effects on the utilization of minerals, calories and nitrogen of increasing the protein content of the diet. Full information concerning the method used and the condition of the children was given in a previous publication.[2] In the first experiment, 2 normal 4½ year old boys were the subjects. They received the constant diet containing 3 Gm. of protein per kilogram of body weight [3] for twelve preliminary and twenty-one collection days. Each child received every food in proportion to his weight; so the results were comparable per kilogram. In order to increase the protein content of the diet, ground beef and whole egg were added and skimmed milk was substituted for part of the whole milk. On a per kilogram basis, these changes increased the protein content of the diet to 4 Gm. and also raised the calcium content from 0.061 to 0.073 Gm., the phosphorus content from 0.069 to 0.086 Gm. and the caloric value from 85.5 to 88.0.

In the second experiment, 3 healthy children, a 4 year old boy and 2 girls who were 3 years old, received diets containing the two levels of protein. The diet containing 3 Gm. of protein per kilogram was continued for ten preliminary and twenty-one collection days and that containing 4 Gm. was used for the succeeding twenty-four days. These two diets were identical except for the increase in protein content, effected by adding egg white and gelatin and omitting sufficient butter to keep the number of calories the same. Thus, the caloric and the mineral content of the two diets was the same.

The purpose of the third experiment was to study the effect on the utilization of minerals, nitrogen and calories of increasing the caloric intake 20 per cent above that of the basal diet used in the preceding experiments. Filtered butter fat, corn starch and sugar supplied the additional calories.

The subjects for this experiment were also normal healthy children. Each child compared favorably in height and weight with the Woodbury [4] standards for a child of his or her particular age (table 1). They all grew rapidly, exceeding the expected rate of growth, and seemed to improve in physical fitness, judging from outward appearance.

The basal diet was continued for twenty-seven consecutive days after a preliminary period of fourteen days. In the second part of the experiment, the filtered butter fat supplement, which raised the caloric value of the diet, was given for a twenty-seven day collection period. At the end of that time isocaloric amounts of corn starch replaced the butter fat for twenty-four consecutive days. In the fourth division of the experiment, increased sugar added the same number of calories for the following twenty-four days.

The technical procedures of all three studies were the same as described in the previous paper.[2] The children lived under carefully controlled conditions on the college campus during each experiment and were under the constant supervision of trained workers. Each experiment was divided into three day collection periods, during which the children had exactly the same foods. Only the perishable foods varied from period to period. The children ate all foods quantitatively.

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2. Hawks, J. E.; Dye, M., and Bray, M. M.: An Improved Technic for Metabolism Studies in Pre-School Children with a Statistical Determination of Its Reliability, J. Nutrition **13**:51-64 (Jan.) 1937.

3. The diets contained milk, eggs, ground beef, whole wheat bread, Ralston's whole wheat cereal, butter, sugar, orange juice, peaches, apple sauce, tomato, string beans, potato, lettuce or celery and cod liver oil.

4. Woodbury, R. M.: Weight-Height-Age Tables for Infancy and Early Childhood, Mother & Child, July 1923, supp.

The specimens of urine were kept on ice until the twenty-four hour samples were complete. Since urinary calories were to be determined, toluene could not be added as a preservative until the end of the twenty-four hour period. Analyses of the specimens were checked for completeness by comparison of the creatinine values obtained. Uric acid values were determined immediately after completion of the twenty-four hour specimen. In the first two experiments the uric acid was precipitated by means of sodium cyanide and silver lactate, as described by Folin.[5] In the third experiment it was determined according to his modified procedure. Triplicate analyses were made in all cases.

RESULTS AND COMMENT

Effect of Increasing the Protein Content of the Diet.—The change from a 3 to a 4 Gm. protein diet produced an increase in the average uric acid elimination for each child, whether the results were expressed

TABLE 1.—*Physical Measurements of Children at Beginning and End of Third Experiment*

Child	Sex	Age, Months	Height, Cm.	Weight, Kg.	Variation from Woodbury Average, per Cent
K.....	M	42	102.6	16.2	+ 0.3
		43	103.4	16.5	+ 0.7
C.....	M	47	103.3	14.9	— 8.5
		50	105.5	17.3	+ 2.3
E.....	M	50	105.5	17.4	+ 2.7
		53	107.0	20.2	+16.3
M.....	F	51	103.5	15.9	— 1.5
		53	104.0	17.4	+ 6.8
J.....	F	55	109.6	16.9	— 0.6
		57	110.9	18.6	+ 1.0
A.....	F	57	101.0	17.2	+ 1.2
		60	103.6	21.1	+30.7

as total grams per day or as grams per kilogram per day (table 2). The percentage increases were in no case as great as the dietary increases of 33⅓ per cent and were not of the same magnitude in the two experiments. In the first experiment, the values increases 26.0 per cent for subject B and 21.5 per cent for subject D, while in the second experiment the figures were only 7.4, 6.7 and 6.9 per cent for subjects V, C and J respectively.

Apparently, the increases in uric acid were related to other changes in diet as well as to the total protein increases, for the latter remained the same in the two experiments, yet the percentage increases varied. Since uric acid is undoubtedly an end product of purine metabolism, the

5. Folin, O.: Laboratory Manual of Biological Chemistry, New York, D. Appleton and Company, 1922, p. 143; Standardized Methods for the Determination of Uric Acid in Unlaked Blood and in Urine, J. Biol. Chem. **101**:111-125 (June) 1923; The Preparation of Sodium Tungstate Free from Molybdate, Together with a Simplified Process for the Preparation of a Correct Uric Acid Reagent (and Some Comments), ibid. **106**:311-314 (Aug.) 1934.

purine content of the diet was an important variable. In the high protein diet of the first experiment there was an increase in purine bodies from exogenous sources, because that diet contained 2.53 Gm. more meat per kilogram than the lower protein diet. In the second experiment, however, there was no increase in dietary purine substances because purine-free food, that is, egg white and gelatin, were used to increase the protein content of the diet. That the increased uric acid production in the first experiment was a result of the added meat is in line with the results of other investigators,[1] who have found that foods containing purine bodies increase uric acid elimination. Von Moraczewski and his co-workers [6] confirmed the work of early investigators by studies in which calf brain, nucleic acid or sodium nucleinate was added to the diets of adults. Leopold, Bernhard and Jacobi [7] found higher values for urinary uric acid after they fed children, between the ages of 7 and 12 years, a mixed high protein diet.

TABLE 2.—*Effect of Increased Dietary Protein on the Average Daily Uric Acid Elimination*

			Uric Acid Elimination, Mg.				
			Total per Day		Amount per Kilogram		
Experiment	Child	Sex	3 Gm. Protein Diet	4 Gm. Protein Diet	3 Gm. Protein Diet	4 Gm. Protein Diet	Percentage Increase Over Value for 3 Gm. Protein Diet
1.....	B	M	109.5	148.0	17.3	21.8	26.0
	D	M	86.4	107.0	14.9	18.1	21.5
2.....	V	M	107.0	117.0	18.8	20.2	7.4
	O	F	95.1	104.9	19.5	20.9	6.7
	J	F	72.7	79.6	16.0	17.1	6.9

While the differences in the purine content of the diets in the present study caused the variations in the results of the two experiments, differences in the amount of dietary purines are not the only cause of variations in uric acid excretion. In the second experiment, purine-free substances were used to increase the protein; yet there was an increase of from 6.7 to 7.4 per cent in uric acid elimination. During the time the children consumed the high protein diet they gained weight more rapidly than they had on the lower protein diet (table 3), and at the same time they actually stored more protein in their bodies, as is shown by the higher

6. von Moraczewski, W.; Grzycki, S.; Jankowski, H., and Sliwinkski, R.: Einfluss der Diät auf die Blutharnsäure und die Harnsäureausscheidung nach nukleinreicher Kost, Arch. f. exper. Path. u. Pharmakol. **165**:482-493, 1932; Sur la teneur en acide urique du sang et l'élimination d'acide urique dans les urines en relation avec le régime, J. de physiol. et de path. gén. **30**:659-665 (Sept.) 1932; Blutharnsäure und Harnsäureausscheidung bei verschiedenartiger Nahrung, Klin. Wchnschr. **12**:738-741 (May 13) 1933.

7. Leopold, J. S.; Bernhard, A., and Jacobi, H. G.: Studies in the Uric Acid Metabolism of Children, Am. J. Dis. Child. **27**:243-255 (March) 1924.

nitrogen retentions.[8] In the manufacture of this protein tissue the body must have synthesized the purine nucleus, since the additional protein in the diet did not contain this nucleus. At the same time, there was an increase, rather than a decrease, in the storage of purine material because the extra muscle tissue must have needed more, rather than less, purines for the additional nucleoprotein in the cells. Extra purines, therefore, must have been synthesized and the excess excreted.

The literature affords other evidence of purine synthesis, both in human beings and in animals. Since Rose [1] reviewed the subject in 1923 there have been a number of further studies. Mělka [9] expressed the belief that there was a synthesis of purine in man because the uric acid excretion of a normal subject on a low purine diet increased after the diet had been consumed for approximately six weeks. Although Degan [10] found that rapidly growing pigs, dogs and rabbits synthesized purines, because allantoin eliminations were higher when the animals were on diets containing purine-free protein than when the diet contained only carbohydrate, he observed that whenever there was a retention of nitrogen

TABLE 3.—*Average Gain in Weight per Day* *

Diet	B	D	E	V	C	J
Medium protein	1.43	0.95	....	3.81	4.29	2.38
High protein	5.33	4.67	0.00	4.58	8.75	8.75

* The gains in weight are expressed in grams.

there was a lower output of purines in the urine. Since the latter fact is exactly contrary to the results of the present study, it may be that the children's manner of utilizing purines was somewhat different from that of the animals. However, in the experiment in which Degan found the lower output of purines, he produced the nitrogen gains by adding carbohydrate, rather than protein, to the diet. Thus it may be that purines were synthesized from protein materials and that added carbohydrate merely spared the purines, thus producing the lower values for the purines excreted. Terroine and his associates [11] found that under

8. Hawks, J. E.; Bray, M. M., and Dye, M.: The Influence of Diet on the Nitrogen Balances of Pre-School Children, J. Nutrition **15**:125-143 (Feb.) 1938.

9. Mělka, J.: Harnsäureausscheidung bei sehr purinarmen Ernährungsweise, Arch. f. d. ges. Physiol. **232**:61-65, 1933.

10. Degan, C.: Le taux d'excrétion purique d'origine endogène est-il une constante caractéristique individuelle? Ann. de physiol. **9**:451-468, 1933; L'excrétion purique endogène dépend-elle de la masse et de la valeur énergétique de la ration? ibid. **9**:469-480, 1933; La formation des corps puriques dans la métabolisme protéique exogène, ibid. **9**:481-493, 1933.

11. Terroine, E. F., and Mourot, G.: La formation des composés puriques aux dépens des matières protéiques dans le métabolisme azoté endogène, Compt. rend.

(Footnote continued on next page)

conditions of endogenous protein metabolism synthesis of purine substances took place at the expense of the protein of the body tissue. If this is true, the purines in the present study were probably synthesized from the additional protein in the diet, even though that protein did not contain purine substances. On the basis of the results of several studies of the purine metabolism of birds, Schuler and Reindel,[12] Benzinger and Krebs[13] and Edson, Krebs and Model[14] all expressed the belief that there was a relation between deaminized ammonia and uric acid production. Thus the purine synthesis in the present study may have occurred on account of the ample supply of ammonia produced from the purine-free protein. Correlations between uric acid excretions and the various urinary nitrogenous constituents gave some evidence that there might be such a relationship for man. In experiment 1, there were higher correlations between the excretions of ammonia and uric acid (0.61 and 0.71 with the 3 and 4 Gm. protein diets respectively) than between those of uric acid and dietary nitrogen, total urinary nitrogen, urea, amino acid, creatine, creatinine or acidity. With the exception of creatine and acidity, with the 4 Gm. protein diet none of the correlations was above 0.5 and the majority of them were very low. In the second experiment, the correlations were in general a little higher than in the first, but again the excretions of uric acid and ammonia showed a closer relation with the 3 Gm. protein diet than did the excretions of uric acid and any of the other constituents, namely, a correlation of 0.77. With the 4 Gm. protein diet, however, the correlation of 0.55 was slightly lower than the correlations for the excretions of urea and total urinary nitrogen. Although these data are not conclusive, they do indicate that ammonia production may be related to uric acid elimination and to purine synthesis.

Acad. d. sc. **195**:1424-1427 (Dec.) 1932. Terroine, E. F.; Giaja, A., and Bayle, L.: Formation de la créatine et des corps puriques au cours de la dégradation des matières protéiques exogènes, Bull. Soc. de chim. biol. **14**:900-915 (June) 1932; La formation de la créatine et des corps puriques de l'urine aux dépens des matières protéiques, Compt. rend. Acad. d. sc. **193**:956-959 (Nov. 16) 1931. Terroine, E. F., and Mourot, G.: L'allantoïne et les corps puriques de l'urine des mammifères proviennent-ils partiellement de la dégradation des matières protéiques? Bull. Soc. de chim. biol. **13**:94-109 (Jan.) 1931.

12. Schuler, W., and Reindel, W.: Die Harnsäuresynthese im Vogelorganismus: II., Klin. Wchnschr. **12**:1479-1480 (Sept. 23) 1933; III. Die Harnsäuresynthese im Taubenorganismus eine Purinsynthese, Ztschr. f. physiol. Chem. **234**:63-82, 1935.

13. Benzinger, T., and Krebs, H. A.: Ueber die Harnsäuresynthese im Vogelorganismus, Klin. Wchnschr. **12**:1206-1208 (Aug. 5) 1933.

14. Edson, N. L.; Krebs, H. A., and Model, A.: Uric Acid Synthesis: The Synthesis of Uric Acid in the Avian Organism; Hypoxanthine as an Intermediary Metabolite, Biochem. J. **30**:1380-1385 (Aug.) 1936.

Changes in the distribution of protein, fat and carbohydrate in the diet, as well as alterations in the caloric content, have been suggested as factors in uric acid production. According to Lockie and Hubbard [15] and Adlersberg and Ellenberg,[16] increasing the fat in the diet lowered the uric acid elimination of adults. Leopold, Bernhard and Jacobi [7] obtained similar results for children. In both experiments of the present study, the 3 Gm. protein diet contained a larger amount of fat than did the 4 Gm. protein diet and produced lower uric acid values per kilogram. The fat increases, however, were so small that it is impossible to compare the results with those of the foregoing authors, because they added large amounts of fat to the diets in order to study the reduction in uric acid elimination. Degan [10] found that additional calories in the form of carbohydrate reduced uric acid elimination. In the first experiment of the present study, the 4 Gm. protein diet contained more calories than the 3 Gm. protein diet but produced higher uric acid values. If the caloric change in the diet influenced uric acid elimination, its effect was entirely obscured by the greater effect of the purine changes. In the second experiment, the caloric values had no influence because they remained exactly the same for the two diets.

The results of the present study showed that the uric acid elimination of the preschool children was influenced by the same factors which modify the uric acid elimination of adults. Dietary increase in purine substance undoubtedly increased uric acid elimination, but in the absence of purine-containing foods there was also a synthesis of uric acid during the period of consumption of the increased protein diet.

Effect of Increasing the Caloric Content of the Diet.—In general, additional calories in the diet from butter fat, corn starch or sugar caused a reduction in uric acid elimination, whether the results were expressed as total milligrams per day or as milligrams per kilogram per day (table 4). The total number of milligrams of uric acid eliminated was lowest during the period that the butter fat supplement was consumed, was higher with the addition of corn starch and increased even more during the period that the sugar supplement was used. In the case of subject E, the value for the sugar supplement period approximated that for the basal diet period, and the same value for subject A was slightly above that for the basal diet period. Judging from these figures alone, one might conclude that supplementary fat as well as supplementary corn starch depressed uric acid excretion but that the addition of sugar had no influence. It must be remembered, however, that the children received food in proportion to body weight and that they gained weight

15. Lockie, L. M., and Hubbard, R. S.: Gout: Changes in Symptoms and Purine Metabolism Produced by High Fat Diets in Four Gouty Patients, J. A. M. A. **104**:2072-2075 (June 8) 1935.

16. Adlersberg, D., and Ellenberg, M.: Effect of Carbohydrate and Fat in the Diet on Uric Acid Excretion, J. Biol. Chem. **128**:379-385 (April) 1939.

at a tremendous rate on the high caloric diets (table 5). Therefore, the intake values were greater during the period that diets supplemented with sugar were used, and results would be comparable with the basal diet values only when expressed per kilogram. On this basis, the reduction below the basal diet values was as low as 11.7 per cent in all cases. There was little difference in the uric acid values with the three high caloric diets, the figures for the period the starch supplement was used being no higher and those for the period the sugar supplement was added being very little higher than the values for the time additional butter fat was consumed.

TABLE 4.—*Effect of Increased Calories from Various Sources on Average Uric Acid Elimination*

	Total Values per Day, Mg.				Values per Kilogram						
						Fat Added		Starch Added		Sugar Added	
Child	Basal Diet	Fat Added	Starch Added	Sugar Added	Basal Diet	Value, Mg.	Percentage Variation from Basal Diet Value	Value, Mg.	Percentage Variation from Basal Diet Value	Value, Mg.	Percentage Variation from Basal Diet Value
K	404	350	...	...	24.8	21.2	—14.5	....	.....	....	.....
C	352	301	324	337	23.5	19.4	—17.5	19.7	—16.2	19.7	—16.2
E	372	322	336	368	21.3	17.6	—17.4	17.5	—17.8	18.4	—13.6
M	359	329	...	...	22.6	19.3	—14.6	....	.....	....	.....
J	351	331	...	...	20.6	18.2	—11.7	....	.....	....	.....
A	406	360	378	429	23.5	19.4	—17.5	19.2	—18.3	20.7	—11.9

TABLE 5.—*Average Gain in Weight per Day* *

Dietary Supplement	K	C	E	M	J	A
None	11	7	6	10	16	14
Butter fat	30	32	39	46	47	47
Corn starch	..	29	29	..	..	42
Sugar	..	35	38	..	..	53

* The gains in weight are expressed in grams.

These results seem contrary to those of many reports in the literature. Lockie and Hubbard,[15] as well as Adlersberg and Ellenberg,[16] said that a high fat diet depressed uric acid elimination to such an extent that symptoms were produced in patients with gout but that the same number of calories from carbohydrate had no such effect. Moraczewski and associates [6] found that uric acid was eliminated more rapidly with a carbohydrate-rich than with a protein-rich diet and least rapidly with a fat-rich diet. Degan [10] found that with a protein-free diet calories from a carbohydrate source in an amount equal to four times the original number caused no increase in the purine elimination of young pigs, nor did the additional calories cause a greater nitrogen retention. However, corn starch added to the diets of rapidly growing animals consuming

skimmed milk caused a reduction in purine elimination and at the same time an increase in nitrogen retention. This fact indicated that growth in the presence of nitrogen consumption, even of that from a nonpurine source, decreased purine elimination. The children in the present study had nitrogen in their diets and were growing very rapidly. This may explain the apparent discrepancy.

In the original plan of this study, the various supplements were to supply a 20 per cent increase in calories, but protein and all other dietary constituents were to remain at the same level. In actual fact, this was not realized (table 6), because two factors could not be controlled. In the first place, the children gained weight (table 5) from three to six times as fast on the high caloric diets as on the basal diet. Although there was a calculated 20 per cent increase in calories at the beginning

TABLE 6.—*Effect of Various Caloric Supplements on Caloric and Nitrogen Content of Diets* *

	Child	Basal Diet	Percentage Variation with Supplement		
			Butter Fat	Corn Starch	Sugar
Calories	K	91.9	19.3	...	....
	C	92.8	17.2	8.3	14.0
	E	94.7	13.2	5.5	12.0
	M	92.2	14.6	...	....
	J	91.1	17.2	...	....
	A	90.5	17.2	7.8	15.1
Nitrogen, Gm.	K	521	.....	.....	.....
	C	525	—4.4	—10.9	— 9.3
	E	536	—7.8	—13.2	—10.8
	M	522	—6.7	.....	.....
	J	516	—4.6	.....	.....
	A	513	—4.7	—11.3	— 8.6

* The changes are expressed per kilogram.

of each twenty-seven or twenty-four day experimental period, at the end of the period the children were actually getting fewer calories and fewer grams of nitrogen per kilogram than at first. Thus the average caloric increase per kilogram was not 20 per cent in any case, and the decreases in the nitrogen intake ranged from 4.4 to 13.2 per cent. In the second place, the values for both starch and sugar obtained by analysis were below the calculated figures. As previously shown in this laboratory [1] and in others,[17] there can be considerable difference between values obtained by analysis and calculated figures.

In spite of the differences in protein intake, the variation between the values obtained by analysis and the calculated figures and the rapid gain in weight, it is possible to point out some differences in the values for uric acid elimination with the addition of fat, starch and sugar to the diets. Although uric acid values were about the same percentage below

17. Donelson, E.; Nims, B.; Hunscher, H. A.; Shukers, C. F., and Macy, I. G.: Simple Methods for Metabolic Balance Studies and Their Interpretation, J. Home Econ. **23**:267-272 (March) 1931.

the basal figures during the consumption of the fat supplement as when carbohydrate was added, that is, from 11.7 to 17.5 per cent for fat and from 11.9 to 18.3 per cent for carbohydrate, additional calories from fat lowered uric acid elimination more than did calories from corn starch or sugar. The evidence for this rests on the fact that there was an uneven reduction in nitrogen intake during the periods the three supplements were used. In all cases the children received less purine and protein substances per kilogram, which, in accordance with the results in the first two experiments, would in itself lower uric acid elimination. Table 6 shows that with the high fat diet protein decreases from the basal diet ranged from 4.4 to 7.8 per cent, while with the diets containing the corn starch and sugar supplements the nitrogen decreases were from 8.6 to 13.2 per cent. Since these protein decreases represented a proportional reduction in purine, as well as nonpurine, substances, they should cause decreases in uric acid elimination proportional to the protein reduction. Thus the lowered protein intake caused a larger part of the reduction in uric acid with the carbohydrate supplement than it did with the fat supplement. Therefore, it seems that the additional calories from corn starch and sugar did not depress uric acid elimination to as large a degree as did the calories from fat.

In reality, starch caused a greater reduction in uric acid than sugar. During the periods that these two supplements were used the nitrogen reductions were similar. The addition of starch increased the calories from 5.5 to 8.3 per cent, while the supplementary sugar increased them to a greater extent, that is, from 12.0 to 15.1 per cent. Nevertheless, the lower percentage increase in calories from the starch supplement caused greater percentage reductions in uric acid elimination (16.2, 17.8 and 18.3 with the starch supplement as compared with 16.2, 13.6 and 11.9 with the sugar supplement).

Thus the data seem to indicate that additional calories from any source reduced uric acid elimination, that calories from fat depressed the elimination more than calories from a carbohydrate source and that starch seemed to reduce uric acid output more than sugar. On this basis the results agree more closely with those of Lockie and Hubbard [15] and Adlersberg and Ellenberg,[16] who stated that fat depressed uric acid elimination more than sugar. The results for their adult patients with gout may have been even more pronounced than those for these normal children.

The fact that the children in the present study gained weight from three to six times as fast during the consumption of the high caloric diets as when the basal diet was used (table 5) may explain why calories from any nonprotein source decreased uric acid elimination. Although the protein content of the diet per kilogram decreased, part of the weight gain was due to the manufacture of protein tissue, because the children stored more nitrogen during the time the high caloric diets were con-

sumed than during the time that the basal diet was used.[18] For the production of this protein tissue, additional purine substances were necessary. They must have been obtained from the protein in the diet or from the purine substances which would otherwise have been eliminated as uric acid. The decided decrease in uric acid elimination with the fat and carbohydrate supplements indicated that the body preserved its supply of purine substances during growth. This fact agreed with Degan's [10] conclusion that with the storage of nitrogen in the body uric acid elimination was reduced.

The fact that the children in experiments 1 and 2 did not have a lowered uric acid elimination when they stored more nitrogen may be explained in relation to the protein content of the diet. On the 4 Gm. protein diets, the children probably had a generous allowance of protein and did not need to conserve any of the purine substances for growth. But in the third experiment, and also in the expermient of Degan, the protein was limited, which forced the body to conserve its supply.

These data may add some evidence to that already accumulated concerning the protein needs of growing children. The nitrogen balances in this study [8] showed definitely that the children developed faster and produced more muscle tissue on the 4 than on the 3 Gm. protein diets. Daniels and her associates [19] stated that preschool children needed 3.2 Gm. of protein per kilogram for optimum storage. The figures in the present study show that with the addition of calories to the 3 Gm. protein diet the body conserved its purine substances by eliminating a smaller amount of uric acid with increased growth. On the 4 Gm. protein diet, body tissue increased to about the same degree but the children eliminated, rather than stored, uric acid. Therefore, 3 Gm. of protein per kilogram does not seem to be sufficient for optimum growth, but 4 Gm. seems to be a generous allowance. This assumption does not preclude the possibility that there may be protein synthesis following the addition of protein to the diet or that some of the purines needed for the growing tissues may have been synthesized.

Daily Variation in Uric Acid Values.—Although the children received the same food per kilogram each day of the constant diets, the uric acid values varied. Tables 2 and 4 clearly show that the average figures were not the same for the individual children. For example, table 4 shows that on the basal diet the subjects excreted from 20.6 to 24.8 mg. of uric acid per kilogram. There were similar fluctuations with the other constant diets. These variations were

18. Hawks, J. E.: Unpublished data.

19. Daniels, A. L.; Hutton, M. K.; Knott, E. M.; Wright, O. E.; Everson, G. J., and Scoular, F.: A Study of the Protein Needs of Pre-School Children, J. Nutrition **9**:91-107 (Jan.) 1935.

probably the result of several factors. Since the nitrogen and the caloric content of the diet varied from period to period, the purine composition probably fluctuated in a similar manner. Second, individual children may have utilized the purines in the diet in a slightly different way, and third, there was a certain degree of experimental error in the uric acid determinations. As was shown in a previous publication,[20] not only did the values for the individual children vary, but the figures for each child varied from day to day. In experiments 1 and 2, the extreme range in variation per period was from 13.5 to 20.0 Gm. per kilogram, with coefficients of variation for the individual children of from 2.0 to 8.6. In experiment 3, the range was from 17.4 to 29.5, with a coefficient of variation for all the children of 9.7. These fluctuations are, without doubt, due to the unavoidable errors which occur in a metabolic study.

SUMMARY

This paper reports urinary uric acid values for preschool children obtained during three long time balance experiments. In the first two experiments the protein content of the diet was increased from 3 to 4 Gm. per kilogram, while in the third experiment the caloric value of the diet was increased approximately 20 per cent.

The change from a 3 to a 4 Gm. protein diet increased uric acid elimination in all cases; purine-free protein caused a smaller increase than meat protein.

There may be a relation between the production of uric acid and that of ammonia, because the correlation between the values for these two constituents was greater than the correlations between the values for uric acid and the other urinary nitrogenous substances.

Additional calories from butter fat, corn starch or sugar decreased uric acid eliminations per kilogram of body weight. The addition of butter fat decreased the elimination to a greater extent than did the carbohydrate supplement. At the same time, supplementary sugar caused less decrease in uric acid elimination than did additional starch.

With an increase in protein alone, as well as with an increase in calories, there were more rapid weight gains that with the basal diet.

Since additional protein or calories from fat, starch or sugar produced similar weight gains and at the same time protein increased and calories from other sources decreased the uric acid elimination of preschool children, 3 Gm. of protein may not be sufficient for optimum growth and protein storage.

The uric acid values were not the same for individual children on a constant diet, and for each child the values fluctuated from day to day.

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20. Hawks, J. E.; Bray, M. M., and Dye, M.: Effect of Diet on the Constancy of the Urinary Nitrogenous Constituents Excreted Daily by Pre-School Children, J. Nutrition **13**:179-192 (Feb.) 1937.

BASAL METABOLISM OF NORMAL INFANTS FROM THREE TO FIFTEEN MONTHS OF AGE

WITH SPECIAL REFERENCE TO TWINS

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The basal metabolism of normal infants has received much less attention than that of older children and adults. The truly basal state as defined for metabolic tests cannot be secured with infants, but the procedure used routinely for tests on children under 2 years of age provides the nearest approach to determination of minimal heat production. For convenience, measurements made under these conditions are considered basal for children of this age group. A detailed review of the early literature is given in the introduction to the monograph by Benedict and Talbot entitled, "The Gaseous Metabolism of Infants."[1] The work of Howland,[2] comparing the direct and the indirect computation of the heat production of 2 normal and 2 emaciated infants, was the direct forerunner of the more extensive study of Benedict and Talbot. The latter investigators made observations on 37 infants, of whom some were normal but many were somewhat underweight.

In 1915 Murlin and Hoobler[3] reported on studies of 10 hospitalized children, aged 2 months to 1 year. Four of the infants were underweight, and, according to present standards, many of the results for the others should be omitted because of activity during the tests.

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A more detailed report of this study will be submitted by Dorothy D. Clagett to the Graduate School of Cornell University in partial fulfilment of the requirements for the degree of doctor of philosophy.

1. Benedict, F. G., and Talbot, F. B.: The Gaseous Metabolism of Infants with Special Reference to Its Relation to Pulse-Rate and Muscular Activity, Publication 201, Carnegie Institution of Washington, 1914.

2. Howland, J.: Der Chemismus und Energieumsatz bei schlafenden Kindern, Ztschr. f. physiol. Chem. **74**:1 (Aug.) 1911.

3. Murlin, J. R., and Hoobler, B. R.: The Energy Metabolism of Ten Hospital Children Between the Ages of Two Months and One Year, Am. J. Dis. Child. **9**:81 (Feb.) 1915.

By far the most extensive study on minimal heat production of infants is that carried out by Benedict and Talbot on a series of 137 healthy infants from 8 days to 25 months of age and reported in their later monograph, "Metabolism and Growth from Birth to Puberty."[4] Repeated tests were made at varying intervals on 23 infants of this group. Talbot used data from this study for the basal metabolism standards for children of this age which are presented in his latest tables.[5]

Levine and co-workers have published a series of papers on respiratory metabolism in infancy and childhood, only one of which need be mentioned here. The summary report by Levine and Marples[6] included data from earlier reports on 8 normal infants and 4 moderately undernourished ones (the latter being between 20 and 35 per cent below normal weight for age). It also included a biometric analysis of the material presented in the study of Benedict and Talbot previously cited[4] and confirmed the general validity of their standards, which were based on body weight, on stature and on a combination of the two. Age was found to have less influence than either body weight or stature.

The only study published on the basal metabolism of twins has also come from Talbot's laboratory.[7] Eighteen pairs of twins were studied, 9 of which were in their first or second year of life. No attempt was made to observe a pair over a prolonged period. Some of these infants were "convalescent from mild illnesses," but no details were given.

The present study was undertaken to follow twins and unrelated infants over a period of months to compare their minimal heat production with Talbot's standards[8] and to determine whether the results for twins show a greater similarity than those for unrelated infants of the same age range living under similar environmental conditions.

EXPERIMENTAL PROCEDURE

Subjects.—Eight healthy infants served as subjects for this study. Marie and Marcia, born Nov. 16, 1936, were identical twins; Paul and Patricia, born July 16, 1937, and Warren and George, born July 23, 1938, were fraternal twins;

4. Benedict, F. G., and Talbot, F. B.: Metabolism and Growth from Birth to Puberty, Publication 302, Carnegie Institution of Washington, 1921.

5. Talbot, F. B.: Basal Metabolism Standards for Children, Am. J. Dis. Child. **55**:455 (March) 1938.

6. Levine, S. Z., and Marples, E.: The Respiratory Metabolism in Infancy and in Childhood: XII. A Biometric Study of Basal Metabolism in Normal Infants, Am. J. Dis. Child. **41**:1332 (June) 1931.

7. Talbot, F. B.: Basal Metabolism of Twins, New England J. Med. **207**: 318 (Aug. 18) 1932.

8. Talbot, F. B.: (*a*) Standards of Basal Metabolism in Normal Infants and Children, Am. J. Dis. Child. **21**:519 (June) 1921; (*b*) footnote 5.

John, born July 24, 1938, and Walter, born July 27, 1938, were unrelated, but they lived under similar conditions in the two homemaking apartments. The birth dates of the last 4 infants were within four days of each other, and the other fraternal twins were born in the same month of the previous year. This circumstance, together with the fact that all of the tests on these 6 infants were run during the winter months of the school year, should eliminate seasonal variation as a cause of the differences found in the results for these infants.

The observed weights and heights of the infants were compared with those given in the tables of Grandprey[9] for children of their ages. The values for 1 infant were in the lower range (0 to 10 per cent) in 3 of 4 tests, and those for 4 others were in the lower normal range (10 to 25 per cent). The values for height for age were in the higher range (75 to 90 per cent) for 1 infant. However, the values for weight for height were all in the middle range (25 to 75 per cent). On the basis of these facts and the medical records, all of the infants were considered normal and well developed for their size.

Apparatus and Method.—The apparatus used for determining the respiratory exchange of the infants was of the open circuit type, and the method employed was essentially that described by Higgins and Bates.[10] Air was collected during alternate two minute periods, and either four or five such periods comprised a test. A Carpenter-Haldane apparatus was used for the analysis of the air samples for carbon dioxide and oxygen. The infants were observed carefully throughout the tests, and activity was classified according to the method of Benedict and Talbot.[1] Only those periods were considered in which there was little or no activity (designated by these authors as activity I or II).

A formula developed by Higgins and published in a paper by Higgins and MacLaren[11] was used to calculate the energy exchange from the data for the four or five short periods which comprised a test. (Later Higgins found that this formula had been previously published by Liebermeister.[12]) The formula was applied to the data for the periods paired in all possible combinations (for example, periods I and II, I and III, I and IV, II and III and so on). The formula is written as follows:

$$a = r\left(y - c + \frac{y-b}{\frac{rt}{e^{v}-1}}\right)$$

in which a represents the number of liters of carbon dioxide produced per minute; r, the number of liters of air passing through the chamber per minute; y, the percentage by volume of carbon dioxide in the chamber during the second period; c, the percentage of cabon dioxide in the incoming air (0.03 per cent); b, the percentage of carbon dioxide in the chamber during the first period; e, the base for natural logarithms (2.718); t, the time in minutes between the midpoints of the first and second periods, and v, the volume of air in the chamber.

9. Grandprey, M. B.: Range of Variability in Weight and Height of Children Under Six Years of Age, Child Development **4**:26 (March) 1933.

10. Higgins, H. L., and Bates, V.: New Method for the Determination of the Basal Metabolism of Babies and of Small Children, Am. J. Dis. Child. **39**: 71 (Jan.) 1930.

11. Higgins, H. L., and MacLaren, W. R.: Simpler Methods for Determining Basal Metabolic Rates of Children, Am. J. Dis. Child. **58**:670 (Sept.) 1939.

12. Liebermeister, C.: Untersuchungen über die quantitativen Veränderungen der Kohlensäure-Production beim Menschen, Arch. f. klin. Med. **7**:75, 1870.

The separate values for "a" were multiplied by the correction factor for temperature and pressure, by the calorific value of carbon dioxide and by 1,440 (minutes) to give the minimal caloric output per twenty-four hours. The average of the several separate values so obtained represented the measured minimal heat production for the test. On the basis of the suggestion of Du Bois [13] and the experimental procedure of Levine,[6] which are applicable when the urinary nitrogen of infants is not measured, it seemed advisable to use calorific values tor carbon dioxide based on the assumption that 15 per cent of the total number of calories was derived from protein metabolism. Lewis and co-workers [14] adopted this procedure, and their table of values for the calorific equivalent of a liter of carbon dioxide was used. The values for respiratory quotients used to determine this equivalent were the averages of the several values obtained from the analyses of the four or five periods comprising the test. Since all of the periods used were supposedly "basal," it was considered that an arithmetic average of all of the separate calculations, instead of an arbitrary choice of some, tended to smooth out the effects of such influences as technical variations and fluctuations in depth of sleep and pulmonary ventilation.

The accuracy of the Carpenter-Haldane apparatus was checked at frequent intervals by analysis of samples of outdoor air, and the chamber was checked by the burning of known quantities of ethyl alcohol. The alcohol lamp used was designed by an engineer at this laboratory. The values for the respiratory quotient of the alcohol varied from 0.655 to 0.675, with an average of 0.665 (theoretic value, 0.667). The difference between the actual and the theoretic amount of carbon dioxide formed varied from -2.39 to $+3.95$ per cent and averaged $+0.91$ per cent. Since there was no difference in the technic used for determinations with the alcohol lamp and that employed in the metabolism tests on the children, it seemed reasonable to assume that the accuracy of the procedure was at least equivalent to that demonstrated by these checks.

Plan of the Experiment.—The energy metabolism tests in this study were made at approximately monthly intervals. Marie and Marcia were observed from the fourth through the fourteenth month, Paul and Patricia from the third through the eight month, Warren and George from the fifth through the tenth month and the nontwins from the third through the ninth month of life. The twins stayed at the laboratory for a minimum of three days each month, and the babies from the homemaking apartments were there for the night preceding the test. All the tests were performed while the infant was sleeping after an early morning feeding of milk or milk and water, the nature of the feeding depending on the age of the infant. The customary routines of the infants were followed as far as possible throughout their stay at the laboratory.

RESULTS AND COMMENT

Curves of the values for total calories plotted against age, weight, height and surface area for the 8 infants and the standards of Talbot are shown in chart 1. The values from Talbot's [5] tables were used to plot the standard curves for weight and height, but the standard curves for

13. Du Bois, E. F.: Basal Metabolism in Health and Disease, ed. 3, Philadelphia, Lea & Febiger, 1936.

14. Lewis, R. C.; Kinsman, G. M., and Iliff, A.: The Basal Metabolism of Normal Boys and Girls from Two to Twelve Years Old, Inclusive, Am. J. Dis. Child. **53**:348 (Jan., pt. 2) 1937.

age and surface area had to be taken from his earlier charts,[8] as no tables were available. The corresponding values for boys and for girls were averaged, since the difference between the values for the two sexes was slight for this age group and the separate curves added to the complexity of the graphs.

Physical measurements were made at the time of 21 of the tests so that the surface area could be calculated from the DuBois [18] linear formula. Comparisons were then made with the values calculated from

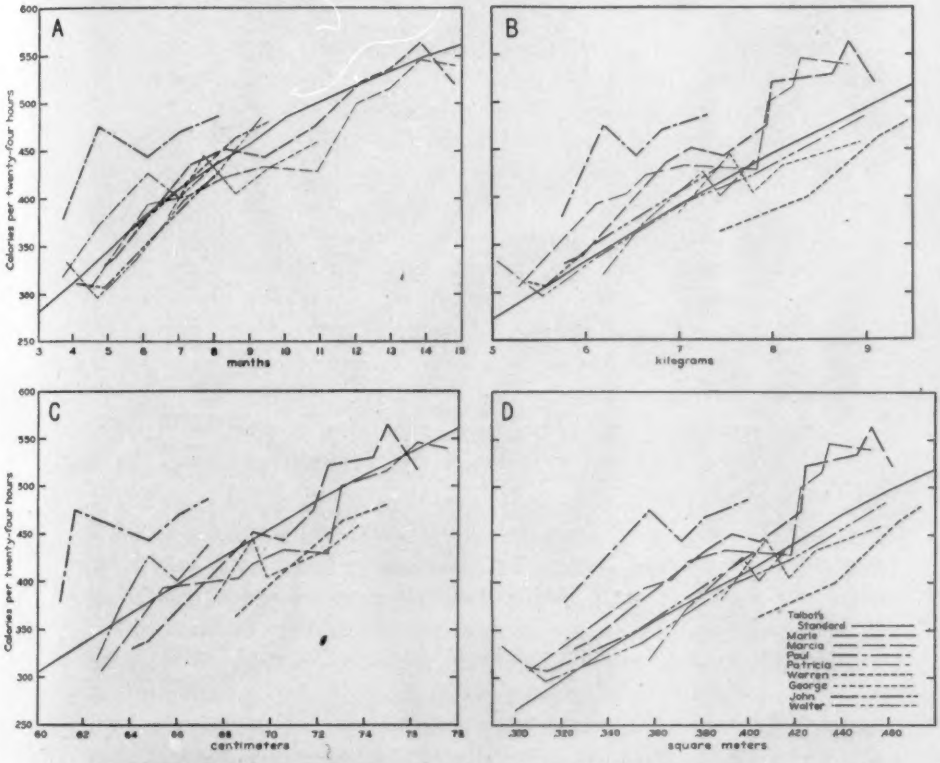

Chart 1.—Total calories per twenty-four hours referred to *A*, age; *B*, weight; *C*, height, and *D*, surface area.

the Hannon modification of the Du Bois [18] height-weight formula, the Benedict and Talbot modification of the Lissauer formula [4] and other modifications of the Meeh formula. Levine and associates used either the Hannon or the modified Lissauer formula in their studies.[15] For the

15. Levine, S. Z.; Wilson, J. R., and Gottschall, G.: The Respiratory Metabolism in Infancy and in Childhood: VIII. The Respiratory Exchange in Marasmus; Basal Metabolism, Am. J. Dis. Child. **35**:615 (April) 1928. Levine and Marples.[6]

children examined in this laboratory the values calculated from the modified Lissauer formula agreed closely with those obtained with the Du Bois linear formula, the difference falling within ± 1 per cent in 7 cases and within ± 6 per cent in all 21 cases. The values obtained with the Hannon formula differed more, as they were 4 to 10 per cent below those calculated from the linear formula in 7 cases and 10 to 16 per cent below in the other 14 cases. None of the other modifications gave values which corresponded more closely with those obtained with the linear formula than did the Lissauer formula; so this formula was used for the calculation of the values for surface area used in this report.

The actual number of calories produced was also compared with the number predicted from Talbot's standard on the basis of actual weight and height and with that calculated on the basis of Woodbury's [16] values for expected weight and height for age. The predicted values and the deviations of the actual number of calories from the predicted values are given in table 1. Although it is recognized that there are too few cases for satisfactory statistical treatment, odds were calculated, using Student's "t" table, as presented by Love,[17] to indicate the significance of the differences of the actual from the predicted values. These odds are presented in table 1. Since a deviation of ± 15 per cent is considered normal for infants (Talbot [5]), both the odds and the deviations have been used in the interpretation of normalcy.

Table 2 summarizes the values for minimal heat production, reported as total calories, calories per kilogram and calories per square meter per twenty-four hours.

Total Calories per Twenty-Four Hours.—Although the values obtained for Marie and Marcia for total calories per twenty-four hours were with very few exceptions within the normal range as judged by the deviations (table 1), they were above the average on the bases of weight and surface area and in closer agreement with the average on the bases of age and height (chart 1). The curves for these twins were similar in form and frequently crossed each other.

The values for Paul were consistently high, being approximately 20 per cent above the standards on all bases. The values for Patricia, his twin, corresponded well with all the standards but were slightly higher than the average on the basis of height.

On the basis of age the values for Warren corresponded closely with those of Talbot's average curve, while on the bases of weight, height and

16. Woodbury, R. M.: Statures and Weights of Children Under Six Years of Age, Publication 87, United States Department of Labor, Children's Bureau, 1921.

17. Love, H. H.: Application of Statistical Methods of Agricultural Research, Changsha, China, The Commercial Press, Ltd., 1938.

surface area they were consistently below the average but still within the normal range. The values for George, his twin, were lower than those for Warren on the basis of age and in some tests on the basis of height but slightly higher than Warren's on the bases of weight and surface area. There was no apparent explanation for the high value found for George in the second test.

Total calories plotted against age gave curves which were almost identical for the nontwins, John and Walter. The values were somewhat low in most of the early tests, but by the seventh month they were in the same range as those for most of the other infants and were approaching the average curves of Talbot. The curves plotted on the bases of weight and surface area differed a little more, but they corresponded closely with the standard curves. Values for these 2 infants based on height were omitted from the graphs because too few measurements of height were made, but the values computed on the basis of those heights which were recorded were within the normal range.

Levine and Marples,[6] in their biometric study of the basal metabolism of normal infants, confirmed the validity of the standards which we have used. Their analysis also indicated that the standards referred to stature were probably the most reliable for prediction of the basal metabolic rate, that the relation of basal metabolic rate to age in itself was apparently trivial and that there was no sex difference in metabolic response during the period of infancy. The results of the present study only partially agree with these conclusions. The predictions on the basis of actual height were better than those based on actual weight for 5 of the infants, those based on actual weight were better for 2, and there were insufficient data on 1 child to make a comparison possible. The expected weight and the expected height were equally good as a basis for prediction for 3 infants, expected weight was somewhat better for 1 and expected height was better for the other 4. If the first 4 infants (Marie, Marcia, Paul and Patricia), who were studied during the first year, are considered separately, it will be noted that the expected weight was the most satisfactory single basis for the prediction of minimal heat production. However, this was not true for the other 4 infants, who were studied the second year. For 3 of these, George, John and Walter, the actual weight was the most satisfactory basis, and for Warren the expected height was the best. For the 8 infants in the present series the least dispersion was found when the total calories were referred to age. This is contrary to the results not only of Levine and Marples but also of Lewis and co-workers [14] for children from 2 to 12 years of age. No sex differences were found for the present series. It is evident that no one basis was uniformly satisfactory for the prediction of the basal metabolic rate of these 8 infants, but if a single means were to be selected age or actual height would be the most satisfactory.

TABLE 1.—*Significance of the Differences Between the Actual and the Predicted Number of Calories Produced*

Subject	Age, Months	Actual		Predicted †		Actual Number of Calories Produced	Number of Calories ‡ Predicted on the Basis of							
							Actual Weight		Actual Height		Predicted Weight †		Predicted Height †	
		Weight, Kg.	Height, Cm.	Weight, Kg.	Height, Cm.		Calories	Percentage Deviation	Calories	Percentage Deviation	Calories	Percentage Deviation	Calories	Percentage Deviation
Marie.....	4.9	5.77	64.1*	6.67	63.8	330	322	2	375	−12	376	−12	370	−11
	5.2	5.96	64.8*	6.80	64.3	338	334	1	385	−12	383	−12	378	−11
	7.3	6.85	68.6	7.67	67.5	435	386	13	442	−2	431	1	426	2
	8.3	7.13	69.2	8.03	68.9	451	402	12	450	0	449	0	446	1
	9.4	7.48	70.5*	8.30	70.1	443	420	5	463	−4	462	−4	463	−4
	10.8	7.93	71.8	8.57	71.7	475	444	7	486	−2	475	0	485	−2
	12.1	7.99	72.4*	8.98	73.0	522	447	17	494	6	495	5	502	4
	12.9	8.63	74.3	9.16	73.8	518	478	8	519	0	503	3	512	1
	12.9	8.63	74.3	9.16	73.8	543	478	14	519	5	503	8	512	6
	13.8	8.80	74.9	9.34	74.7	564	486	16	526	7	511	10	523	8
	14.7	9.08	76.2*	9.53	75.6	516	500	3	541	−5	520	−1	534	−3
	14.8	9.08	76.2*	9.53	75.7	528	500	6	541	−2	520	2	535	−1
							odds>9,999:1 §		5:1 §		2:1 §		1:1 §	
Marcia.....	4.5	5.28	62.8*	6.49	63.0	307	291	5	354	−13	365	−16	357	−14
	6.1	6.12	65.4	7.21	65.8	393	343	15	395	−1	406	−3	401	−2
	7.3	6.44	68.6	7.67	67.5	408	362	11	442	−9	431	−6	426	−5
	8.3	6.64	69.2	8.03	68.9	422	374	13	450	−6	449	−6	446	−5
	9.4	7.07	70.5*	8.30	70.1	433	399	9	463	−6	462	−6	463	−6
	10.9	7.83	72.4	8.71	71.8	429	439	−2	494	−13	482	−11	486	−12
	12.0	7.95	73.0	8.98	72.9	500	445	12	502	0	495	1	501	0
	12.9	8.21	74.9	9.16	73.8	492	458	7	526	−6	503	−2	512	−4
	13.0	8.21	74.9	9.21	73.9	541	458	18	526	3	505	7	514	5
	13.8	8.29	76.2	9.34	74.7	546	462	18	541	1	511	7	523	4
	14.7	8.80	77.5*	9.53	75.6	528	486	9	555	−5	520	2	534	−1
	14.8	8.80	77.5*	9.53	75.7	552	486	14	555	−1	520	6	535	3
							odds>9,999:1 §		195:1 §		4:1 §		13:1 §	
Paul.....	3.7	5.74	61.0*	6.49	62.7	379	314	21	315	20	359	6	331	15
	4.7	6.19	61.6	7.08	64.8	475	341	39	324	47	394	21	372	28
	6.1	6.54	64.8	7.76	67.2	443	362	22	372	19	432	3	408	9
	7.0	6.81	66.0*	8.12	68.6	469	379	24	390	20	451	4	429	9
	8.1	7.30	67.3	8.53	70.0	486	406	20	409	19	471	3	450	8
							odds>525:1 §		369:1 §		21:1 §		122:1 §	

Patricia.....	3.7	6.18	62.6*	6.03	61.4	318	347	−8	351	−9	338	−6	331	−4
	4.7	6.61	63.5	6.58	63.4	371	372	0	365	2	370	0	363	2
	6.1	7.25	64.8	7.21	65.8	426	408	4	385	11	406	5	401	6
	7.0	7.44	66.0*	7.57	67.1	401	418	−4	404	−1	425	−6	420	−5
	8.1	7.80	67.3	7.98	68.6	438	437	0	423	4	447	−2	442	−1
							odds 3:1 §		2:1 §		3:1 §		1:1 §	
Warren.....	5.5	7.43	68.5	7.48	66.6	363	414	−12	427	−15	416	−13	399	−9
	6.7	8.37	70.1*	7.98	68.1	400	463	−14	451	−11	444	−10	421	−5
	8.6	9.13	73.0	8.66	70.6	450	501	−10	495	−9	478	−6	450	−2
	8.6	9.13	73.0	8.66	70.6	477	501	−5	495	−4	478	0	459	4
	9.5	9.43	74.9	8.94	71.6	480	516	−7	521	−8	492	−2	474	1
							odds>525:1 §		454:1 §		44:1 §		3:1 §	
George.....	6.7	6.96	67.6*	7.98	68.1	382	389	−2	414	−8	444	−14	421	−9
	7.7	7.54	69.2	8.39	69.5	445	420	6	438	2	464	−4	442	1
	8.6	7.79	69.8	8.66	70.6	405	433	−6	447	−9	478	−15	459	−12
	9.6	8.10	72.4	8.98	71.8	433	450	−4	486	−11	494	−12	477	−9
	10.9	8.93	73.7	9.30	73.2	459	491	−7	505	−9	510	−10	498	−8
							odds 6:1 §		54:1 §		454:1 §		80:1 §	
John.....	4.1	5.33	....	6.71	63.6	311	290	7	...	..	373	−17	351	−11
	4.9	5.57	....	7.21	65.2	307	304	1	...	..	402	−24	378	−19
	6.0	6.04	....	7.71	67.1	349	332	5	...	..	429	−19	406	−14
	8.2	7.39	67.9	8.53	70.1	432	411	5	418	−2	471	−8	451	−4
							odds 53:1 §				184:1 §		75:1 §	
Walter.....	3.7	5.05	....	6.49	62.7	333	273	22	...	..	359	−7	331	1
	4.7	5.54	....	7.08	64.8	296	302	−2	...	..	394	−25	372	−20
	5.8	6.11	66.0	7.62	66.8	336	337	0	390	−14	424	−21	402	−16
	7.1	7.12	....	8.16	68.7	397	397	0	...	..	453	−12	430	−8
	8.0	7.79	70.5	8.48	69.9	423	433	−2	457	−7	469	−10	448	−6
	9.3	8.97	....	8.89	71.4	485	493	−2	...	..	489	−1	471	3
							odds 2:1 §				127:1 §		21:1 §	

* Estimated value.
† Values calculated from Woodbury's [10] tables.
‡ Values calculated from Talbot's [9] tables.
§ Value calculated from Student's "t" table in Love: Application of Statistical Methods of Agricultural Research, Changsha, China, The Commercial Press, Ltd., 1938.

TABLE 2.—*Summary of Values for Minimal Heat Production*

Age, Months	Weight, Kg.	Surface Area,* Sq. M.	Calories per 24 Hours		
			Total	Per Kg.	Per Sq. M.
Marie					
4.9	5.77	0.325	330	57	1,015
5.2	5.96	0.332	338	57	1,018
7.3	6.85	0.382	435	64	1,139
8.3	7.13	0.393	451	63	1,148
9.4	7.48	0.405	443	59	1,094
10.8	7.93	0.422	475	60	1,126
12.1	7.99	0.424	522	65	1,231
12.9	8.63	0.446	518	60	1,161
12.9	8.63	0.446	543	63	1,217
13.8	8.80	0.452	564	64	1,248
14.7	9.08	0.461	516	57	1,119
14.8	9.08	0.461	528	58	1,145
Average				61 ± 3 †	1,138 ± 70 †
Marcia					
4.5	5.28	0.306	307	58	1,003
6.1	6.12	0.355	393	64	1,107
7.3	6.44	0.367	408	63	1,098
8.3	6.64	0.374	422	64	1,128
9.4	7.07	0.390	433	61	1,110
10.9	7.83	0.418	429	55	1,026
12.0	7.95	0.422	500	63	1,185
12.9	8.21	0.431	492	60	1,142
13.0	8.21	0.431	541	66	1,255
13.8	8.29	0.434	546	66	1,258
14.7	8.80	0.452	528	60	1,168
14.8	8.80	0.452	552	63	1,221
Average				62 ± 3 †	1,133 ± 78 †
Paul					
3.7	5.74	0.321	379	66	1,181
4.7	6.19	0.357	475	76	1,330
6.1	6.54	0.371	443	68	1,194
7.0	6.81	0.381	469	69	1,231
8.1	7.30	0.399	486	67	1,218
Average				69 ± 4 †	1,231 ± 53 †
Patricia					
3.7	6.18	0.357	318	51	891
4.7	6.61	0.373	371	56	995
6.1	7.25	0.397	426	59	1,073
7.0	7.44	0.404	401	54	993
8.1	7.80	0.417	438	56	1,050
Average				55 ± 3 †	1,000 ± 63 †
Warren					
5.5	7.43	0.404	363	49	899
6.7	8.37	0.437	400	48	915
8.6	9.13	0.463	450	49	972
8.6	9.13	0.463	477	52	1,030
9.5	9.43	0.473	480	51	1,015
Average				50 ± 1 †	966 ± 51 †
George					
6.7	6.98	0.387	382	55	987
7.7	7.54	0.408	445	59	1,091
8.6	7.79	0.417	405	52	971
9.6	8.10	0.428	433	53	1,012
10.9	8.93	0.456	459	51	1,007
Average				54 ± 3 †	1,014 ± 41 †
John					
4.1	5.33	0.305	311	58	1,020
4.9	5.57	0.314	307	55	978
6.0	6.04	0.352	349	58	991
8.2	7.39	0.402	432	58	1,075
Average				57 ± 1 †	1,016 ± 37 †
Walter					
3.7	5.05	0.294	333	66	1,133
4.7	5.54	0.313	296	53	946
5.8	6.11	0.354	336	55	949
7.1	7.12	0.392	397	56	1,013
8.0	7.79	0.417	423	54	1,014
9.3	8.97	0.458	485	54	1,059
Average				56 ± 4 †	1,019 ± 64 †

* Values calculated from the Benedict-Talbot revision of the Lissauer formula.[4]
† Standard deviation from the mean.

Calories per Kilogram per Twenty-Four Hours.—As another means of comparing the minimal heat production of the infants, the values were calculated on the basis of calories per kilogram per twenty-four hours. Chart 2 illustrates this comparison graphically. Talbot [4] observed for normal children in the first two years of life a range of 41 to 64 calories per kilogram per twenty-four hours. Table 2 shows that the average values for all the infants in this series, with the exception of Paul, fell well within this range. Values for Paul were consistently high. One value for Marie, two for Marcia and one for Walter also exceeded this range.

The values for each individual child were relatively constant throughout the period of observation. There were some fluctuations, but they

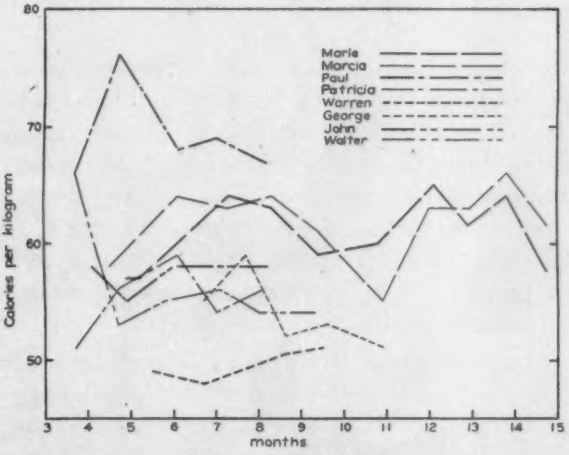

Chart 2.—Calories per kilogram referred to age.

were in the same range as variations in the results of tests performed within a few days of each other. For Marie and Marcia, who were followed for the longest period, a variation of 0 to 8 calories per kilogram was found from month to month and of 1 to 6 calories per kilogram in the tests not more than three days apart. The standard deviation from the average figure was ± 3 calories in each case. In some of the shorter series for other infants the standard deviation was only ± 1 calory. Talbot,[7] in his study on twins, considered a deviation of 10 per cent from the average as the limit of normal variation, and he classed as "nearly identical" tests showing differences of as much as 8 calories per kilogram for infants in this age range. Therefore, these variations could well be due to daily fluctuations in the infant's basal metabolic rate or to errors in the method.

Since comparison of the values for total calories on the basis of weight showed that those for Paul were highest, those for Marie and Marcia next and those for Warren lowest, it was to be expected that the same results would be evident on the basis of calories per kilogram. Comparison of the twins on this basis showed that Marie and Marcia, the identical twins, had the most similar values. The values for Paul and Patricia, fraternal twins, were the most dissimilar. The values for Warren and George, also fraternal twins, were similar, particularly for the tests at 8.6 months and those at 9.5 and 9.6 months of age. However, John and Walter, the homemaking apartment babies, were just as similar in basal metabolic rate as were Warren and George and much more alike than Paul and Patricia. The nontwins showed the greatest relative gain in weight during the study, but they maintained a nearly constant heat production per kilogram throughout the period of observation.

Benedict and Talbot [4] stated that a somewhat lowered basal metabolic rate per kilogram of body weight was found during the first six months and that the highest values were observed at 1 to 2 years of age. However, no such trend could be determined during the period these children were under observation. A range of 48 to 76 calories was found for individual values for the infants, but the values for each child were relatively constant. The values of Benedict and Talbot for the individual children of the group of 23 on whom repeated tests were made did not show the trend indicated in the composite curves.

Calories per Square Meter per Twenty-Four Hours.—The values for minimal heat production were also computed as calories per square meter of body surface. Benedict and Talbot reported a range of 750 to 1,200 calories per square meter per twenty-four hours for boys and of 675 to 1,300 calories for girls during the first year of life. Levine and associates observed a somewhat narrower range of variation, equivalent to 993 to 1,308 calories, for the boys they examined. The range found in the present study was 891 to 1,330 calories, and the distribution is shown in table 2 and chart 3.

Here, as in the comparison of the calories per kilogram, the variation between the results of successive tests was frequently greater than the standard deviation from the mean; and the variations were both positive and negative, showing little definite trend. A possible trend toward increased metabolism per square meter at the age of about 12 months, when the weight was about 8 Kg., was observed for Marie and Marcia, but if the lower value rather than the average value had been used for tests run on successive days this increase in metabolism would have been less evident. There were a number of irregular values, sudden increases or decreases in basal metabolic rate, which may have been due

to normal fluctuations or to some special metabolic condition in the individual child at the time of the test. Such variations make it difficult to be certain that a trend exists. A probable trend upward can be observed for all of the infants except Paul and George by the elimination of one value, but such eliminations are not justified by any observable differences in the procedure during those tests.

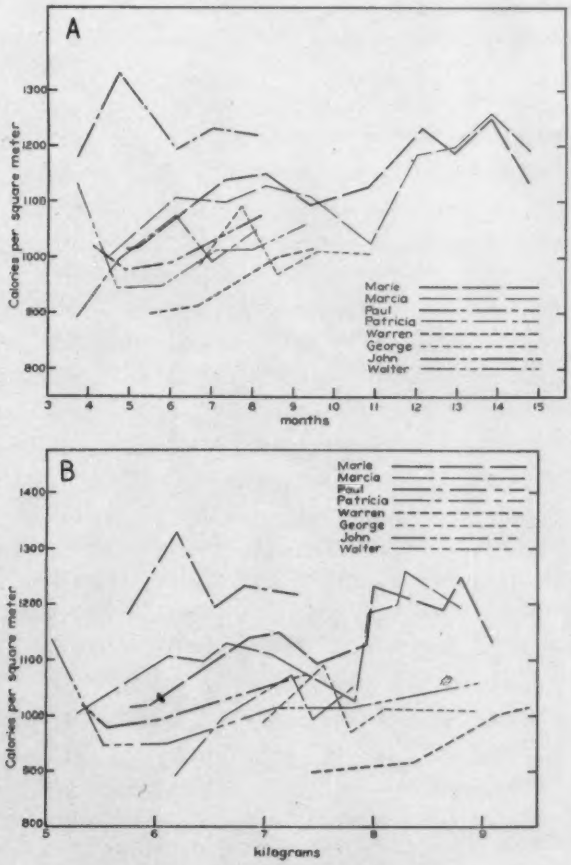

Chart 3.—Calories per square meter of surface area referred to *A*, age, and *B*, weight.

SUMMARY AND CONCLUSIONS

The basal metabolism of 8 normal infants was measured at approximately monthly intervals for periods of five to ten months. The tests were made by means of the open circuit chamber method and the Carpenter-Haldane gas analysis apparatus and were performed on sleeping infants after an early morning feeding.

The results have been reported in terms of the total calories per twenty-four hours referred to age, weight, height and surface area and calories per twenty-four hours per kilogram and per square meter. These values were also compared with the corresponding standards for the basal metabolic rate of children given by Talbot. These comparisons are shown in a series of graphs.

It is difficult to draw general conclusions from the results of the series of tests. The infants showed considerable fluctuations in basal metabolic rate from period to period, regardless of the basis on which it was reported.

However, on the basis of the observations on these 8 infants it seems that the following statements can be made:

1. The total caloric production increased with growth at a relatively uniform rate.

2. The least dispersion was found when total calories were referred to age.

3. For individual infants the values for calories per kilogram were relatively constant throughout the series of observations.

4. The values for calories per square meter for 6 of the 8 infants showed a tendency to increase during growth.

5. No one basis was uniformly satisfactory for the prediction of the basal metabolic rate.

6. Comparison of the basal metabolic rates of the twins and the nontwins showed that the rates of 2 nontwins may be as similar as or more similar than those of twins. The widest difference was found in the values for the fraternal twins of different sex, but the basal metabolic rate of the boy in this pair was markedly higher than the rates for the rest of the group.

Prof. Helen Monsch planned and directed this study during 1937-1938.

PHYSICAL AND CHEMICAL PROPERTIES OF SPUTUM

I. FACTORS DETERMINING VARIATIONS IN PORTIONS FROM DIFFERENT PARTS OF THE TRACHEOBRONCHIAL TREE

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Clinical differences in the sputum in various diseases are well recognized. Their significance is striking in such diseases as postoperative massive collapse of the lung,[1] bronchiectasis [2] and laryngotracheobronchitis,[3] in which the tenacity or viscosity of the secretion plays an important role in bronchial obstruction. A review of the literature in search of accurate data regarding the nature of such differences reveals that the majority of studies deal with the morphologic characteristics or bacteriologic phases of the problem. Studies regarding the leukocytes, lymphocytes and eosinophils, the fibrin or mucin content of sputum and the significance of connective tissue elements are extremely important. Similarly, studies of the bacteria found in sputum as well as observations on the action of bacteria and enzymes in producing physical changes, such as liquefaction,[4] aid in understanding the differences noted clinically. However, it seemed justifiable to undertake an investigation to ascertain the physical and chemical properties of sputum and to determine the properties responsible for the clinical difference other than those due to cytologic or bacteriologic factors.

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From the Department of Pediatrics and the Department of Otology, Rhinology and Laryngology (Bronchoesophagology), University of Illinois College of Medicine.

1. Jackson, C., and Lee, W. E.: Acute Massive Collapse of the Lungs, Ann. Surg. **82**:364-389 (Sept.) 1925.

2. Holinger, P H.: The Role of Inflammatory Bronchial Stenosis in the Etiology of Bronchiectasis, Ann. Otol., Rhin. & Laryng. **47**:1070-1082 (Dec.) 1938.

3. Brennemann, J.; Clifton, W. M.; Frank, A., and Holinger, P. H.: Acute Laryngotracheobronchitis, Am. J. Dis. Child. **55**:667-693 (April) 1938.

4. Jackson, C., and Jackson, C. L.: The Bronchiectatic Septic Tank—Its Prophylaxis and Treatment, Am. Rev. Tuberc. **30**:599-606 (Dec.) 1934.

Observations on the production of sputum and the physiologic aspects of its expectoration were best summarized by Gordonoff,[5] who stated that the thick scanty secretion of the alveoli and the terminal bronchioles is first diluted, or liquefied, by the addition of the secretions of the glands lining the walls of the bronchial mucosa. He further stated that one portion is resorbed after this liquefaction, while other parts are resorbed only after having been made resorbable by a process of digestion which takes place in the alveoli themselves. The remaining material is moved from the alveoli to the bronchioles, the small bronchi and, finally, to the larger bronchi by the kinetic energy of the respired air. It is then coughed out or moved onward by the ciliary action of the mucosa of the larger bronchi and the trachea. The peristaltic action of the bronchial musculature in this regard is still under discussion.

Relatively few statements regarding the physical and chemical composition of sputum are to be found in the literature. According to von Hoesslin,[6] sputum contains 2.42 per cent inorganic and 6.01 per cent organic solids. Wells [7] gave the following data: 5 to 6 per cent solids, including 2 to 3 per cent mucin; 0.1 to 0.5 per cent protein; 0.3 to 0.5 per cent fat, and 0.8 to 0.9 per cent ash. He stated that the output of nitrogen via the sputum is about 0.75 Gm. per day.

MATERIAL AND METHODS

The normal secretions of the tracheobronchial tree are not, in the usual sense, sputum. When these physiologic secretions and exudates become copious enough to be expectorated a pathologic condition exists; consequently, under ordinary circumstances there is no "normal" sputum obtainable. Thus in a study of the effect of various agents on bronchopulmonary secretions normal subjects could not be used. Therefore in most instances the sputum of patients with bronchiectasis was obtained for the examinations. The patients were educated to expectorate material which came only from the lungs into beakers in the presence of one of us. The inaccuracies produced by the addition of saliva would be significant in an accurate study of the sputum as it exists in the tracheobronchial tree. Samples with the slightest admixture of saliva were discarded. Most of the examinations were made on children, and consequently the total volume, or weight, of sputum was purposely omitted from study after we found that its accuracy could in no manner be assured. This conclusion was reached after the total daily volume of sputum was recorded for as long as seventy-one days without our obtaining consistent results with regard to the amount produced. This was true in spite of

5. Gordonoff, T.: Physiologie und Pharmakologie des Expektorationsvorganges, Ergebn. d. Physiol. **40**:53-100, 1938.

6. von Hoesslin, H.: Das Sputum, Berlin, Julius Springer, 1921; Die Untersuchung des Auswurfes, in Abderhalden, E.: Handbuch der biologischen Arbeitsmethoden, Berlin, Urban & Schwarzenberg, 1927, vol. 5, pt. 4, chap. 2, pp. 1375-1418.

7. Wells, H. G.: Sputum, in Chemical Pathology, ed. 5, Philadelphia, W. B. Saunders Company, 1925, pp. 229-302.

the fact that constant results with regard to the composition of the sputum could be obtained. The situation was the same with and without treatment, because children swallow portions of the sputum and it may be lost otherwise, no matter how strict the control which is kept. They frequently chew gum and thereby further dilute the sputum with saliva.

Frequent bronchoscopic aspirations provided an even more accurate method of obtaining material for study and provided a constant check for the material coughed up. Bronchoscopic suction also provided a means of studying the sputum in various levels of the tracheobronchial tree. Bronchoscopic examinations were made without inducing anesthesia, so that any effect which an anesthetic, either local or general, might have had on results could be eliminated. Further, if bleeding occurred during a bronchoscopic examination, either because there was oozing or because of inflammation of the mucous membranes, the specimen obtained was not considered as "pure." No patient with a marked pulmonary suppurative process, either an abscess or far advanced bronchiectasis, was used in this study.

Immediately after the sputum was obtained its hydrogen ion concentration was ascertained, since it was found that the p_H changes relatively soon after collection. A colorimetric method employing the Clark-Lubs [8] buffer solution, ranging in p_H from 5.0 to 8.0, was used.

The total nitrogen content was determined by the Koch-McMeekin method,[9] modified for the analysis of sputum. By this method determinations may be made with as little as 0.5 Gm. of fresh sputum. The procedure used was as follows:

One cubic centimeter of 50 per cent (by volume) sulfuric acid was added for every 0.25 Gm. of sputum. The mixture was made up to the smallest convenient definite volume with 50 per cent sulfuric acid and a 2 cc. sample pipetted out. The sample was digested and cooled and 30 per cent hydrogen peroxide (superoxyl), 1 drop for each 0.1 Gm. of sputum, added; digestion was continued until the mixture was clear. It was then diluted to make 50 cc., and 5 cc. was removed and diluted to make 35 cc. Then 15 cc. of Nessler's solution was added, and the preparation was thoroughly mixed and compared with a standard in a colorimeter.

The chloride content was determined by a modification of Whitehorn's [10] method for the determination of blood chlorides. The procedure adopted was as follows:

A sample of sputum was weighed out in a graduated tube and concentrated nitric acid was added. The mixture was allowed to stand until digestion was complete and was then made up to a definite volume (10 cc.). To a 3 cc. sample of the nitric acid digest 5 or 10 cc. of a solution of silver nitrate was added. The mixture was allowed to stand for five minutes and was then titrated with potasium sulfocyanate, ferric alum being used as an indicator.

The determination of the dried residue was made after twenty-four hours in a drying oven at 104 C. This same sample was ashed for twenty-four hours in a muffle furnace (670 to 720 C.).

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8. Clark, W. M.: Determination of Hydrogen Ions, ed. 3, Baltimore, Williams & Wilkins Company, 1928.

9. Koch, F. C., and McMeekin, T. L.: A New Direct Nesslerization Micro-Kjeldahl Method and a Modification of the Nessler-Folin Reagent for Ammonia, J. Am. Chem. Soc. **46**:2066-2069, 1924.

10. Whitehorn, J. C.: System of Blood Analysis: Supplement II. Simplified Method for Determination of Chlorides in Blood or Plasma, J. Biol. Chem. **45**:449-460, 1921.

As was previously mentioned, one of the most important determinations to be made was that of tenacity. For these determinations an attempt was made to use the apparatus constructed by Jochims [11] for the measurement of the tenacity of the sputum in cases of pertussis. However, this method depends on the formation of threads of sputum and could not be adapted to this study, because the sputum of patients with bronchiectasis is not consistent with regard to the formation of threads. The viscosimeter originally described by Bottaci and Neumann,[12] with certain modifications, proved reliable and gave good results (fig. 1). In this apparatus, sputum under constant pressure is forced through a horizontal glass tube 2.5 mm. in diameter. The time, in seconds, required for the column to advance 4 inches (10 cm.) under constant temperature is regarded as the measure of the viscosity. Thus, the viscosity rather than the tenacity of the sputum was used to indicate its physical quality.

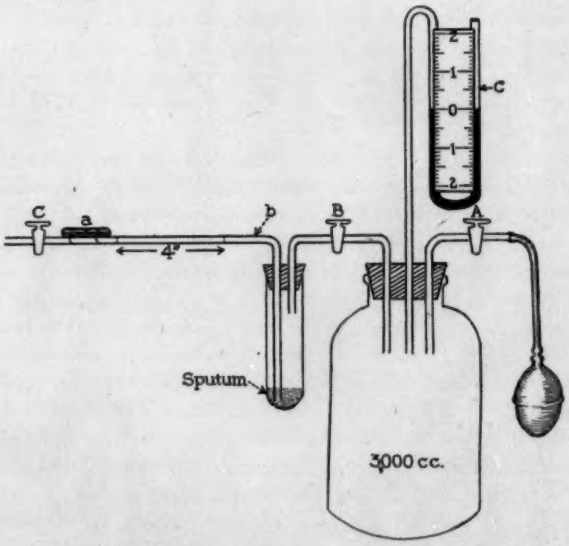

Fig. 1.—Diagrammatic representation of the viscosimeter used in the study. By means of the rubber bulb a positive pressure is produced in the 3,000 cc. bottle, which is measured in the manometer, *c*. Sputum is then forced under constant pressure through the tube *b* by opening the stopcocks, *B* and *C*, and the time required for it to advance 4 inches (10 cm.) is measured. The bubble in level *a* must be maintained in the center point.

RESULTS

In order to have comparable figures, the sputum of untreated patients was used for examinations. In the case of 2 patients, from whom sputum

11. Jochims, J.: Zur Methodik der Messung der Spinnfähigkeit; nebst Spinnfähigkeitsuntersuchungen an Eiklar, Kolloid-Ztschr. **43**:361-366, 1927.

12. Neumann, L.: Untersuchung über die Viscosität des Sputums und ihre Beziehung zum Husten, insbesondere zur Pertussis, Arch. f. Kinderh. **35**:3-41, 1902. Bottaci, cited by Neumann.

was collected as previously described, it was noted that the first material actually obtained from the tracheobronchial tree by postural drainage after a rest period was extremely viscid. It was thicker than that obtained subsequently, when more "normal" sputum was raised. The constancy with which such a small "first portion" was obtained from the 2 carefully controlled hospitalized patients was significant.

The first and second portions obtained by postural drainage could be distinctly separated. The first portion was always small, never measuring more than 5 to 10 cc. regardless of the total amount of

TABLE 1.—*Comparison of the Physical and Chemical Qualities of the First and Second Portions of Sputum*

Patient	Portion of Sputum	Viscosity	p_H	Ash		Total Nitrogen Content		Chloride Content	
				Dried Residue, %	Total Sputum, %	Dried Residue, %	Total Sputum, %	Dried Residue, %	Total Sputum, %
N. C.	1st	Higher	8.2	...	1.1	17.4	4.9	0.3	1.7	0.10
	2d	Lower	8.2	6.3	0.9	17.3	6.0	0.4	1.9	0.12
N. C.	1st	Higher	8.2	8.0	1.3	16.2	...	0.5	1.4	0.11
	2d	Lower	8.0	8.0	1.0	10.6	8.5	0.8	3.3	0.30
N. C.	1st	Higher	7.8	7.3	0.9	13.0	8.9	0.64	1.8	0.13
	2d	Lower	8.0	7.0	0.9	14.0	7.3	0.52	1.9	0.13
N. C.	1st	Higher	8.0	8.3	0.7	8.1	10.1	0.8	...	....
		Lower	8.0	7.5	0.8	10.7	9.4	0.7	...	....
N. C.	1st	Higher	8.0	7.5	0.9	12.6	7.8	0.50	1.1	0.08
	2d	Lower	8.0	7.0	0.8	12.2	7.8	0.55	1.1	0.08
V. W.	1st	Higher	...	9.0	0.7	8.1	22.0	2.05	0.42	0.04
	2d	Lower	...	9.3	0.8	8.2	18.8	1.74	0.57	0.05
V. W.	1st	Higher	...	7.6	0.8	10.4	...	...	...	....
		Lower	...	9.7	0.8	8.5	...	...	...	....
V. W.	1st	Higher	...	7.4	0.8	11.5	11.0	0.81	1.70	0.12
	2d	Lower	7.8	9.2	0.7	8.5	17.3	0.50	1.25	0.12
V. W.	1st	Higher	...	7.8	0.6	7.4	...	...	...	....
	2d	Lower	...	10.1	0.8	7.7	...	...	...	....

sputum coughed up. It was always extremely thick and viscid, its viscosity being higher than that of any other expectorated material. In almost two thirds of the samples from these 2 patients examined the dried residue, the amount of ash and the total nitrogen content were lower in this first portion than in the subsequent portions. The consistent differences between this sputum and that which followed were of a physical rather than a chemical nature (table 1).

Sputum which is raised by ordinary cough and during postural drainage has been designated as the "second portion." It is the largest in volume of the total sputum content of the trachea and bronchi and is identical with that first aspirated when a bronchoscope is inserted into the trachea of a patient with copious sputum. It usually has a relatively high dried residue and a constantly high percentage of ash.

The amount of total nitrogen was irregular. The viscosity of this portion was definitely and constantly lower than that of the other portions (table 2).

It has been noted many times [13] that even after a most thorough evacuation of the tracheobronchial tree by means of postural drainage a marked amount of secretion may be left in the bronchi. This sputum,

TABLE 2.—*Comparison of the Physical and Chemical Qualities of the Second and Third Portions of Sputum* *

Patient	Portion of Sputum	Viscosity	p_H	Dried Residue, %	Ash		Total Nitrogen Content	
					Total Sputum, %	Dried Residue, %	Dried Residue, %	Total Sputum, %
N. C.	2d	Lower	8.2	3.1	0.5	15.0	5.9	0.18
	3d	Higher	7.8	4.3	1.0	25.0	3.7	0.15
V. W.	2d	Lower	8.0	8.9	0.8	8.7	...	....
	3d	Higher	8.0	10.0	0.9	9.4	...	....
V. W.	2d	.....	...	7.5	0.8	10.0	8.1	0.61
	3d	.....	...	8.0	0.9	11.2	11.3	0.90
V. W.	2d	Lower	...	6.2	0.9	15.1	...	....
	3d	Higher	...	8.2	1.0	11.8	...	....

* A large number of additional observations in this series are reported in part 2 of this study, which deals with the influence of therapeutic measures on sputum.

TABLE 3.—*Physical and Chemical Qualities of the Sputum of Two Patients with Massive Postoperative Atelectasis of the Lung*

Date	Patient	Viscosity	p_H	Dried Residue, %	Ash		Total Nitrogen Content		Chloride Content	
					Total Sputum, %	Dried Residue, %	Dried Residue, %	Total Sputum, %	Dried Residue, %	Total Sputum, %
12/20/38	B. A.	Higher	7.8	4.3	0.8	18.3	5.4	0.2	2.2	0.9
12/23/38		Lower	7.8	7.8	0.9	11.9	11.1	0.9	1.4	0.11
11/26/38	A. P.	Higher	7.8	7.2	0.8	11.0	14.2	1.0	...	....
		Lower	7.8	11.8	1.0	8.2	...	...	...	....
		Lower	6.8	11.5	1.0	8.5	8.9	1.0	...	....

which may be obtained only by bronchoscopic suction, differs chemically and physically from that regularly expectorated and is not merely residual sputum. It has been designated as the "third portion" and is characterized by a relatively high dried residue and percentage of ash. The most interesting property of this portion of sputum is its extremely high viscosity. While the viscosity of the coughed-up sputum may be

13. (*a*) Samson, P. C.: Bronchoscopy in Chronic Nontuberculous Infections of the Lung, Am. Rev. Tuberc. **38**:688-702 (Dec.) 1938. (*b*) Jackson, C., and Jackson, C. L.: Peroral Pulmonary Drainage: Natural and Therapeutic, with Especial Reference to the "Tussive Squeeze," Am. J. M. Sc. **186**:849-854 (Dec.) 1933.

measured in terms of seconds, the aspirated material requires several hours to pass through the viscosimeter tube. Furthermore, the viscosity of coughed-up sputum remains relatively constant for several hours, while the aspirated material becomes even more viscous during the first ten or twenty minutes after it is obtained, in some cases almost solidifying (table 2).

Further observations regarding differences between the thick and the thin sputum were made on the material obtained by bronchoscopic suction from 2 patients with postoperative massive collapse of the lung. These patients received no treatment other than bronchoscopic suction. The sputum in both cases became thinner during the course of the disease and, as is usual, became liquefied in the later stages. This material is characterized by a markedly higher dried residue and amount of ash than that obtained immediately after the onset of the disease (table 3).

The character of the mucous membrane also has an important influence on the sputum. Its bronchoscopic appearance in relation to the type of secretion present will be discussed in a subsequent paper.

COMMENT

In this study, sputum was obtained from various levels of the tracheobronchial tree for analysis. It has been found that both physically and chemically sputum may be divided into three types, which must not be confused with the classic three layers into which the sputum of patients with abscesses of the lung or bronchiectasis separates on standing.

The uppermost layer, or first portion, of sputum coughed up has been found to be a bronchial mucus plug, which differs chemically and physically from sputum found at other levels in the tracheobronchial tree. Bronchial plugs of thick sputum are discussed in the literature [14] but actually are seldom seen, because if one searches for the plug bronchoscopically it is lost during the cough which accompanies either the insertion of the bronchoscope or the administration of the preliminary local or general anesthetic or during the unavoidable changes in posture made prior to the bronchoscopic examination. The first portion, or plug, is a pathologic product and cannot be considered as resulting from a physiologic change which normal bronchopulmonary secretions undergo before they are coughed up. It is considered that those changes occurring in the sputum of the tracheobronchial tree which produce this plug are caused by drying alone. The high viscosity, the relatively low content of organic and inorganic solids and the low total nitrogen content indicate that the sputum in the plug has become more

14. Holinger, P. H.: So-Called "Unresolved Pneumonia": Bronchoscopic Aspects, M. Clin. North America **22**:97-106 (Jan.) 1938.

tenacious in spite of a lowering of the dried residue and amount of ash. Thus, an increase in the viscosity is not always accompanied by or dependent on an increase of solid substances.

The sputum which has been designated as the second portion is in reality a product of that which comes from the most dependent portion of the tracheobronchial tree, namely, the third portion, and therefore the latter will be discussed first.

The sputum constituting the third portion is found in the most dependent parts of the bronchial tree and remains after the most vigorous postural drainage has cleared the trachea and the larger bronchi of their contents. Its presence has been demonstrated repeatedly by bronchoscopic aspiration after postural drainage,[14] and it may be obtained only by bronchoscopic suction. Further evidence of its presence is revealed by serial roentgen studies (fig. 2). The first roentgenogram

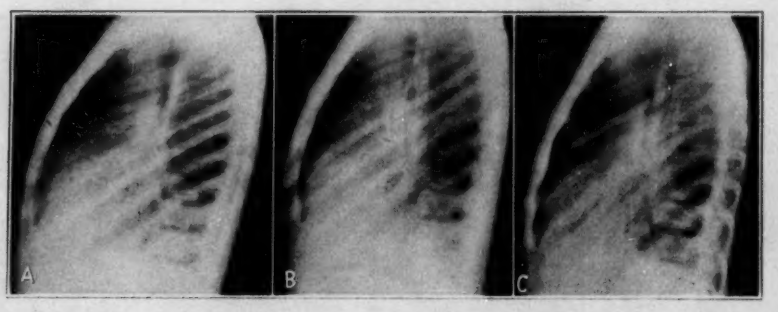

Fig. 2.—Serial lateral roentgenograms of the chest. *A*, taken before the patient coughed on awakening; *B*, taken after postural drainage, and *C*, taken after bronchoscopic drainage.

was made immediately after the patient awakened, before he had coughed. The second was taken after thorough evacuation of the sputum in the tracheobronchial tree had been effected by means of postural drainage, and the third was made after the pus remaining after postural drainage had been aspirated bronchoscopically.

Sputum of the third portion is of the highest viscosity and becomes even more viscous when removed from the bronchi by aspiration and allowed to stand. Sputum raised spontaneously by cough does not have this property. It is significant that the essential difference between aspirated and coughed-up sputum lies in the fact that the former does not come in contact with other parts of the respiratory or the digestive tract. Consequently, it has not been exposed to the action of saprophytic bacteria or to the influence of the mucous membranes and mucosal glands of the upper portions of the respiratory tract. It is most likely the effects of these factors, which are produced as the

sputum moves higher in the tracheobronchial tree, which are responsible for the stability of the coughed-up portion.

The second portion must be considered a diluted sputum, since it has a lower viscosity than sputum obtained from portions of the tracheobronchial tree above or below it and contains smaller amounts of organic and inorganic substances. The process by which the secretion in the most dependent portions of the lung, namely, the third portion of sputum, advances to become the second portion is of considerable interest. Certainly the secretory pressure of the bronchial mucosa and the pressure of accumulated secretions must be considered, as well as the cough and the ciliary action. The latter action is practically eliminated from consideration in the case of the patient with bronchiectasis, because by the nature of the disease the cilia are usually destroyed or clogged to inactivity by the thick secretions in this portion of the lung. The cough reflex must be one of the most important mechanisms in this process. That portion of sputum expelled or moved from one level of the tracheobronchial tree to another by the blast of air, or the kinetic energy of the bechic blast, lies at a higher level, however. The important phase of the cough reflex in this area is the tussive squeeze stressed by Jackson and Jackson.[13b] They described the tussive squeeze as the compression of the lung during cough, comparing the bronchiectatic lung filled with mucopus to a sponge filled with water. The action of the tussive squeeze on the bronchiectatic lung is similar to that of squeezing on the sponge, its action being greatest at the end of the cough cycle. This phase of the action of moving secretions from a dependent to a higher area has been observed by them repeatedly in bronchoscopic studies.

The movement of the lung during the respiratory cycle likewise plays a significant role in the flow of secretions from one level of the bronchial system to another.

The liquefaction of the sputum was also studied by determining the variations which occur in the sputum of patients with postoperative atelectasis during the course of the disease. It is well recognized that the large quantity of very thick, viscid mucus present the first day or two of the disease gradually becomes thinner spontaneously. The liquefied sputum is characterized by a lower viscosity but does contain an increased amount of organic and inorganic material. It is unquestionably true that one of the factors responsible for this situation is bacterial liquefaction. Moreover, with the increase in the inflammatory process, liquefying material is secreted into the bronchi, and this material also dilutes their solid content.

Thus, sputum of different viscosities is formed by reactive processes within the bronchi. Changes resulting in a dilution may take place by the secretion of liquid substances into the sputum, by resorption

of solid substances from the sputum or by bacterial or enzymatic liquefaction. Probably all of these mechanisms are responsible for the changes which occur during the dilution of the third portion as it advances to become the second portion. On the other hand, the mechanism for the formation of the plug is probably principally one of drying. Thus, the lowering of the viscosity of the sputum is not always followed by a lowering of its content of organic and inorganic material.

SUMMARY AND CONCLUSIONS

The physical and chemical qualities of sputum under varying conditions are discussed.

The tracheobronchial tree of patients with bronchiectasis contains three essentially different types of sputum, which are not to be confused with the three layers into which the sputum of patients with bronchiectasis or abscess of the lung divides on standing.

To effect the series of the changes which occur spontaneously in the sputum during its movement from the lowest to the highest levels of the tracheobronchial tree, from which it may be coughed out, certain physical, chemical and bacteriologic actions take place. The changes are not due to physical processes which cause liquefaction or thickening, because a parallel has not been found between the viscosity and the content of solid substances of the sputum.

The secretion from the most dependent portion of the tracheobronchial tree, designated as the third portion, is never coughed up but is obtainable only by bronchoscopic suction. It has an extremely high viscosity and a high content of organic and inorganic substances. This sputum becomes even thicker after it is removed from the bronchi.

The third portion is moved to a higher level both by the tussive squeeze and by the pressure of secretions to form the second portion, which is found in the trachea and the larger bronchi. The second portion is a liquefied sputum which has a lower viscosity, a lower dried residue and a lower percentage of ash than the third portion.

On the top of this secretion, after a rest period, a plug is found which has a moderately high viscosity but a dried residue and percentage of ash which are even lower than those of the second portion.

The sputum of patients with massive collapse of the lung shows a decrease in viscosity during the course of the disease in spite of a marked increase in its content of organic and inorganic material. This spontaneous dilution is probably due to bacterial action.

The characteristic properties of the sputum of patients with bronchiestasis and postoperative massive collapse of the lung may be due to a variety of factors which may be summarized as follows: (1) selective secretion, (2) selective resorption, (3) speed of movement of secretions from one level to another, (4) bacterial action and (5) combinations of the foregoing factors.

INCIDENCE AND NATURE OF FETAL ARRHYTHMIAS

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AND
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Hyman [1] has secured phonocardiograms of three types of fetal arrhythmia, namely, sinus arrhythmia, ventricular extrasystole and auricular fibrillation. Sinus arrhythmia is characterized by frequent slowing and speeding of the heart rate without the superimposition of additional beats or the elimination of expected beats. It should be easily recognized. The question of the cause of this phenomenon is of interest. In children one type of sinus arrhythmia is referred to as respiratory arrhythmia because the periods of rapidity and slowing of the heart beat usually conform to expiration and inspiration. While fetuses do exhibit on occasion what have been described as respiratory movements, such movements are minimal except in critical oxygen deprivation (Barcroft [2]) and would hardly, at their rate of 45 to 60 per minute, be responsible for the much less frequent alterations in heart rate shown in Hyman's tracings. In short, such arrhythmia is not the usual respiratory arrhythmia of children. The many thousands of fetal heart records we have taken have revealed many instances of arrhythmia which appears similar to the type Hyman described as sinus arrhythmia. In them are indications of frequent and marked changes in heart rate. The heart rates have been recorded by two methods, by employing the stethoscope and the chronograph (Sontag and Richards [3]) and by the phonocardiograph. In the chronographic method 10 beats are counted, the chronograph being put in action by pressing a telegraph key on the count of one and releasing it on the count of eleven. Figure 1 shows three records made in this way of hearts showing marked arrhythmia. Since the chronograph pen moves exactly 1 cm. per second, the base of each spike on the record repre-

From the Samuel S. Fels Research Institute, Antioch College.

1. Hyman, A. S.: Am. J. Obst. & Gynec. **20**:332-347 (Sept.) 1930.

2. Barcroft, J.: The Brain and Its Environment, New Haven, Conn., Yale University Press, 1938.

3. Sontag, L. W., and Richards, T. W.: Studies in Fetal Behavior: I. Heart Rate as a Behavioral Indicator, in Monographs of the Society for Research in Child Development, Washington, D. C., National Research Council, 1938, vol. 3, no. 4, serial no. 17.

sents the time in seconds required for 10 beats. The shorter the spike the faster the heart rate and vice versa. Since each 10 beat count, together with the preparation for starting the next count, requires roughly six or seven seconds, the average number of heart rate samplings per minute is about nine.

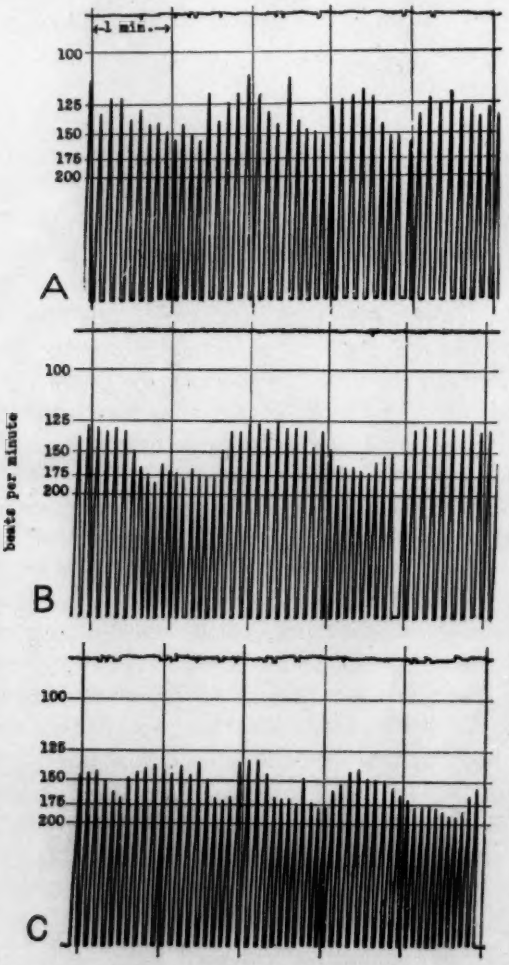

Fig. 1.—Sample records of heart rates, showing the frequency of marked changes.

The irregular spacing of the beats (arrhythmia) in figure 2 *B*, a phonocardiographic record, is self explanatory. This type of record is a simpler way of demonstrating the irregularity, but while simpler it is less adequate for showing sinus arrhythmia because only changes during a very few beats may be used for illustrating the phenomenon

while the chronographic records, because of their compactness, show the changes occurring during a period of several minutes. Figure 2 *A* is a phonocardiogram of a rather regularly beating heart.

The arrhythmias demonstrated in figure 1 are fairly marked. The difference in heart rate represented by the difference in length between the longest and the shortest spikes in figure 1 *A* is 45 beats. The longest spikes represent rates of 109 to 111 per minute and the shortest rates from 150 to 154. In figure 1 *B* the range is from 125 to 182 and in figure 1 *C* from 132 to 177. The rate of change varies tremendously,

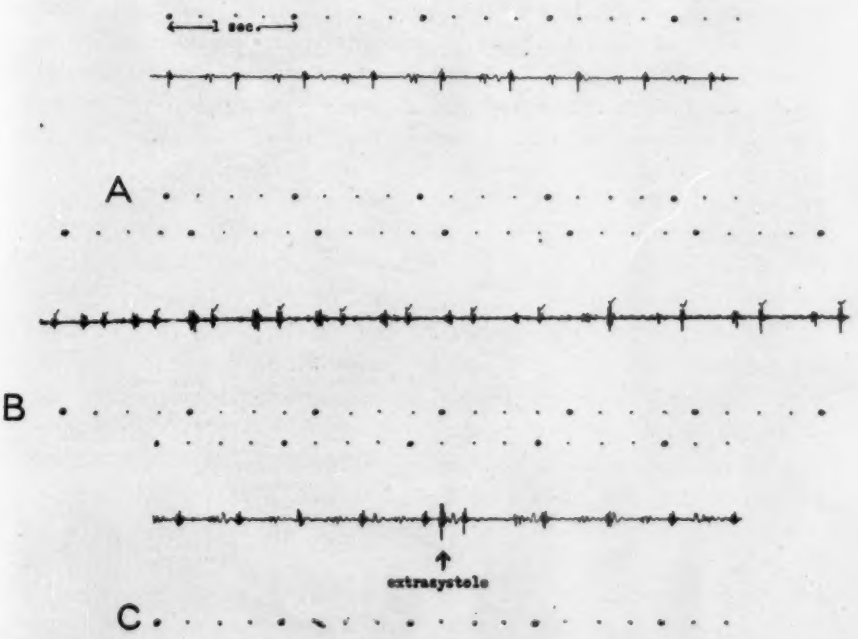

Fig. 2.—Phonocardiographic records, showing, *A*, regular rate; *B*, marked slowing in the course of 10 beats, and, *C*, extrasystole.

but major swings seem to occur at anywhere from ten or fifteen seconds to two or more minutes.

As has been previously explained (Sontag and Newbery [4]), the range of the fetal heart rate is, in the majority of cases, great. It is not in the occasional case that marked variability is shown; it is in the usual case. The fetus which on examination today has a fairly regular heart rate may tomorrow show marked and frequent variations in rate. While there is a difference between fetuses with respect to the degree and

4. Sontag, L. W., and Newbery, H.: Normal Variations of the Heart Rate During Pregnancy, Am. J. Obst. & Gynec. **40**:449-452 (Sept.) 1940.

the frequency of arrhythmia, there is an almost equally great difference between the records of the same fetus on different days. If the proper record is picked from an adequate sampling for any one fetus, it is almost always possible to demonstrate a so-called sinus arrhythmia. The question of why there is so great a variability from hour to hour and from day to day we are not in a position to answer adequately. There are, however, some interesting points which have a bearing on it. First, there is a considerable relation between movement by the fetus and a change in its heart rate. Sontag and Wallace [5] and Sontag and Richards have previously mentioned this phenomenon. Second, the fetal circulatory system is susceptible to any stimulation it may receive from changes in such products as epinephrine and acetylcholine in the mother's blood stream. Third, the existence of the fetal startle reflex (Sontag and Wallace, Sontag and Richards) makes it seem probable that loud sounds and perhaps mechanical stimuli are responsible for some instances of cardiac acceleration and deceleration (fig. 3). Fourth, the developmental state of the fetal autonomic system—the fact that its functions are probably not yet completely established to the degree that they are in childhood—may well result in a rather poorly balanced and erratic cholinergic and adrenergic control of rate. Thus it seems to us that the marked disturbances in fetal cardiac sinus rhythm which are so common as to be the rule are probably the result of a marked exercise response, an environmental stimulus and the developmental state of the autonomic nervous system.

Extrasystoles of the fetal heart, according to the literature, are not infrequent. Hyman observed 6 instances among 21 examples of fetal arrhythmia. Barre and Henriet [6] reported that extrasystoles were noted in a fetus when hydramnios was present. Bondi [7] expressed the belief that all irregularities of the fetal heart are rare except during severe labor, when the fetus is in distress. Rihl and Weinzierl [8] and others have reported instances of fetal extrasystoles. Most observers, however, attach no pathologic significance to their occurrence. They are not known to be associated particularly with congenital cardiac lesions or with any other fetal disturbance. A similar statement may be made about the occurrence of extrasystoles during early childhood, although in this instance they probably do occur with relatively greater frequency in cases of cardiac damage of congenital or infectious origin.

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5. Sontag, L. W., and Wallace, R. F.: Changes in the Rate of the Human Fetal Heart in Response to Vibratory Stimuli, Am. J. Dis. Child. **51**:583-589 (March) 1936.

6. Barre and Henriet: Bull. Soc. d'obst. et de gynéc. **24**:74 (Jan.) 1935.

7. Bondi, J.: Zentralbl. f. Gynäk. **50**:2624 (Oct. 9) 1926.

8. Rihl, J., and Weinzierl, E.: Arch. f. Gynäk. **130**:626-645, 1927.

Hyman has published phonocardiograms illustrating this phenomenon. In his cases the arrhythmia disappeared within the first few weeks after birth. He confirmed his phonocardiographic diagnosis of extrasystole during the prenatal period by means of electrocardiographic examinations of the newborn infant which disclosed the same phenomenon. The apparent skipping of heart beats observed or recorded before delivery and again after delivery was found to be due to ineffective right ventricular extrasystoles.

During the past few years we have had an opportunity to study 92 fetal hearts at frequent intervals, often throughout the last four

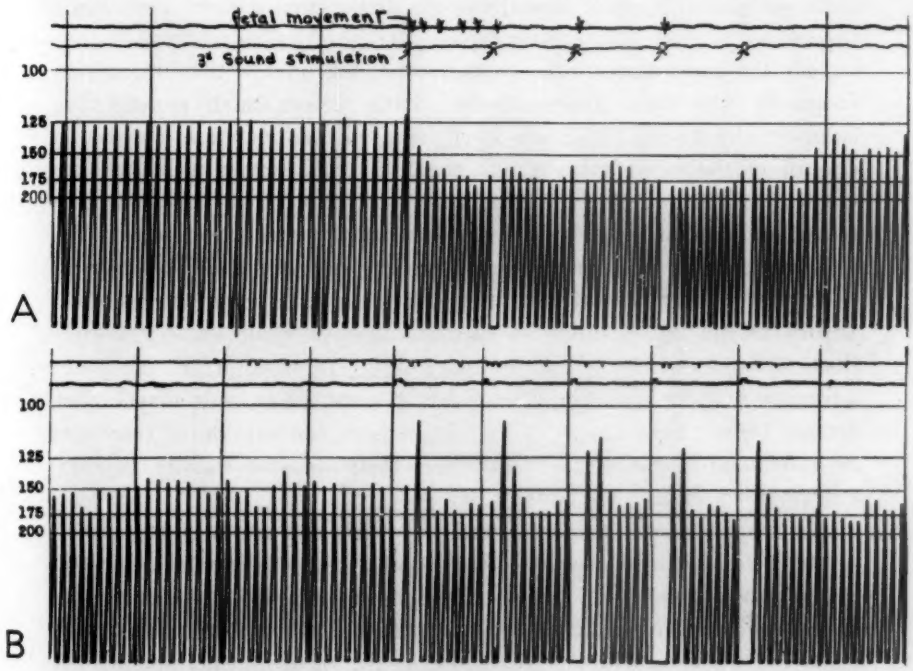

Fig. 3.—Sample records of heart rates, showing, *A*, marked acceleration, and, *B*, brief deceleration followed by acceleration. The changes were the result of external stimulation, the sounding of a buzzer with a frequency of 120 vibrations per second.

months of pregnancy and in some instances for a slightly longer period. During this time we have observed 4 fetuses with readily recognizable extrasystoles. The last 2 of these fetuses we have been able to study almost daily, and we have thus been able to observe the developmental picture of the phenomenon. Figure 2 *C* shows a phonocardiographic tracing for 1 of these fetuses. The recording apparatus used consists of the microphone placed against the maternal abdomen, an audio-amplifier or condenser-coupled amplifier and a recording pen. The

fact that we are able to use the recording pen rather than a photographic device for recording the waves enables us to make much longer and more frequent visual records than might otherwise be possible. In both of the cases mentioned the fetal heart rate was observed on from four to six days each week, the average daily period of observation being about twenty minutes. Observations were begun at from sixty-five to one hundred and twenty days before delivery and were continued until the birth of the child. Sporadic fifteen minute determinations of the heart rate were made for the infants after birth. The bulk of the observations were made by means of a stethoscope and the chronograph. To aid in identifying the arrhythmia records were made by means of the phonocardiograph. In the 2 cases mentioned previously the appearance of the extrasystoles, the time of their maximum frequency and their disappearance shortly before birth appeared to coincide with a period of active development of the function of autonomic control of the heart rate, which, together with factors affecting frequency, suggests that the arrhythmia itself may be at least partially dependent on this genesis of sympathetic-parasympathetic function.

Extrasystoles may arise from a variety of causes. They may be produced by any one of a number of toxins, for example, nicotine. Injury to the myocardium, to the sinoauricular node or to the conduction bundles may cause extrasystoles. Depression of the sinoauricular node or irritation of the auriculoventricular node may induce ectopic beats. Stimulation of the sympathetic innervation of the heart or injection of epinephrine into the circulation will usually produce extrasystoles in animals and in man.

In the cases we have observed in which extrasystoles have been present over a period of weeks there has been no evidence of any toxic or metabolic disturbance which could have been responsible for the disturbance in rhythm, although, of course, such a cause cannot be ruled out. As has already been stated, the developmental picture of such arrhythmia suggests that it may be linked with the growth and the development of function of the autonomic nervous system. In the cases we have observed the extrasystole first appeared during the ninth lunar month of pregnancy, from forty to fifty-five days before birth. The frequency increased from as low as once in 76 beats to as high as once in every 2 or 3 beats. Maximum frequency was attained between the twenty-eighth and the thirty-fifth day before birth. From this point the incidence declined, and the extrasystole disappeared entirely at from thirteen to six days before birth. Figure 4 shows the time of occurrence, the frequency and the time of disappearance of the ectopic beats. Postnatal heart records failed to show any evidence of

extrasystole. The most recent instance we have observed was first noted while the fetus was being tested for response to sound stimuli applied to the maternal abdomen. The response was characteristic, being what is considered to be a pronounced body startle accompanied by a sudden acceleration in heart rate. On several occasions immediately after the sound stimulation, when the fetal heart was beating at the rate of about 200 per minute, extrasystoles were observed to be much more frequent than at any other time. Heart rates almost as rapid as these had been observed in this fetus under other conditions without there being a comparable increase in the frequency of extrasystoles. One possible inference from these observations is that the large component of sympathetic response involved in the startle reflex in the fetus is responsible for the increased frequency of extrasystoles observed in the case described.

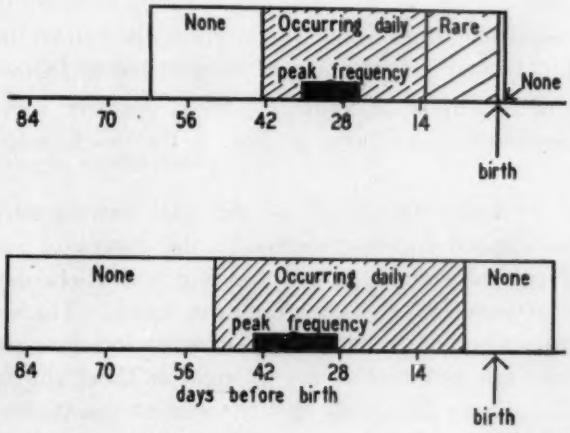

Fig. 4.—Occurrence of extrasystoles in 2 fetuses undergoing almost daily observation.

During the early weeks of fetal life the origin of the heart beat is independent of the sinoauricular node. The first impulses originate in the wall of the left ventricle (Windle[9]). In other words, at this stage of development all beats are ectopic. Tables of the development of function of the vagus and of the sympathetic system indicate that at this time there is no autonomic control of rate or of the irritability of the impulse-generating areas. Later the entire heart beat is brought under the control of the sinoventricular node and still later under that of the sinoauricular node. Slowly, throughout fetal life, the sympathetic and vagus fibers begin to assume the function of controlling the

9. Windle, W. F.: Physiology of the Fetus, Philadelphia, W. B. Saunders Company, 1938, p. 11.

heart rate. This development of autonomic control appears to be very gradual. Windle cited the observations of a number of workers to show that cardiac response to vagus stimulation is usually either absent or at a lower than adult level in several species of animals during late fetal life. In the dog and cat there is no cardiac response to carotid sinus stimulation until several days after birth. Sontag and Richards have expressed the belief that the gradual slowing of the fetal heart rate during the later months of pregnancy, as well as the nature of accelerational and decelerational curves during this period, is closely associated with the development of vagus function. It would not be remarkable, therefore, if during this period of transition and growth the developing autonomic system should depress the sinoauricular node sufficiently to cause ectopic beats again to originate in the ventricular muscle.

Our reasons for believing that the origin of the extrasystoles is associated with autonomic growth may be summarized as follows:

1. One of the effects of stimulating the sympathetic nervous system or of administering epinephrine in man is the development of extrasystoles.

2. The developmental curves of the fetal extrasystoles we have observed correspond in some degree to the curves of variability in fetal heart rate previously plotted (Sontag and Richards) and may perhaps be a product of the same causative factor. The variability of the fetal heart rate (range within each minute) increases steadily from an early fetal age and reaches a maximum at about the fourth week before birth. From then until birth it remains essentially unchanged or possibly declines slightly between that time and birth. This increased variation in rate may be interpreted as due to increased autonomic stimuli or to increased autonomic function preceding somewhat the development of an adequate homeostatic function or greater autonomic stability.

3. Increase in heart rate, which may be presumed to be the result either of increased sympathetic stimulation or of decreased vagal inhibition, is accompanied by a marked increase in the frequency of extrasystoles.

4. The startle, or moro, reflex which results from such stimulation apparently includes a considerable sympathetic response, including usually a marked and immediate acceleration of the heart rate. The exaggeration of the extrasystoles from such sound stimulation is much greater even than would be anticipated with a comparable heart rate in an unstimulated fetus.

SUMMARY

Arrhythmias of the fetal heart are common; they are principally of sinus origin. Periods of frequent and cyclic variations of rate are common for almost all fetuses and may be discovered if an adequate sampling is made. Such variations are affected by external stimuli in the form of pressure, vibration, fetal movement or chemical changes in the blood. The immature state of the fetal autonomic system may well be the factor which makes these stimuli so effective. Extrasystoles were found in 4 of the 92 fetuses studied. For 2 of the fetuses records were made almost daily. The phenomenon appeared about the sixtieth day before birth, attained its maximum frequency about the thirtieth day, gradually became less frequent and disappeared about a week before birth. Our observations lead us to believe that the appearance, accentuation and disappearance of fetal extrasystoles correspond with a developmental phase of the autonomic system. Marginal factors of some sort probably are involved and account for their appearance in only a few fetuses. These marginal factors may consist of such elements as rapidity of growth of the autonomic system, degree of autonomic balance and chemical changes in the maternal blood.

Case Reports

MYOSITIS OSSIFICANS PROGRESSIVA

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In spite of the many studies on myositis ossificans progressiva which have been carried out the nature of the disease is still obscure. Several types of therapy have been tried but have proved unsuccessful. Mair [1] prepared an extensive review of the literature on the disease up to 1932. In 1936 Uehlinger [2] published a report after detailed study of 2 cases and estimated that the number of cases which have been observed was about 160. Burgerhout,[3] in the Netherlands, gave a detailed description of the disease in 1898.

The following case was carefully studied from several points of view.

REPORT OF A CASE

History.—A girl born July 8, 1934 was the third of 4 children; the 3 siblings are healthy. The mother was healthy and had never had an abortion; her father had diabetes mellitus. The father of the patient occasionally complained of discomfort in his stomach; he was a heavy smoker. One sister of the father had short thumbs, a second died of carcinoma of the breast and a third was in a sanatorium for tuberculosis but she had had no contact with the patient. Insanity had occurred in the father's family.

The patient was born normally at full term; she cried immediately. Her birth weight was 4,800 Gm. She was tall and weak but showed no other peculiarities at birth. For three months she was exclusively breast fed. After the third month she was given a vitamin D preparation and from the sixth month on cod liver oil. The teeth appeared in due time. At 16 months of age the child walked alone. When she was 3 years old she contracted measles but has had no other childhood diseases. At the age of 4 years she was immunized against diphtheria.

When the girl was 11 months old the parents consulted one of us because her thumbs were too short and her big toes were in valgus position. There were no symptoms of any disease at that time. At the age of about 1½ years, in conjunction with bilateral otitis media the girl had swelling of the face and eyelids,

From the Pediatric Clinic of the University of Amsterdam.

1. Mair, W. F.: Myositis Ossificans Progressiva, Edinburgh M. J. **39**:13 (Jan.); 69 (Feb.) 1932.

2. Uehlinger, E.: Myositis ossificans progressiva, Ergebn. d. med. Strahlenforsch. **7**:175, 1936.

3. Burgerhout, H.: Algemeene progressieve spierverbeening, zgn. Myositis ossificans progressiva multiplex, Thesis, Leiden, G. L. van den Berg, 1898.

which soon disappeared but was succeeded by a swelling in the back of the neck and shortly by swelling of the front part of the neck and the back. The motility of the head became restricted, and soon the subcutaneous tissue and the muscles were affected. Three weeks after the beginning of otitis, in January 1936, a specimen for biopsy was taken from the distal part of the right sternocleidomastoid muscle, the firmness of the swelling in this region being particularly noticeable. Examination of the tissue by the late Dr. van Ryssel showed the

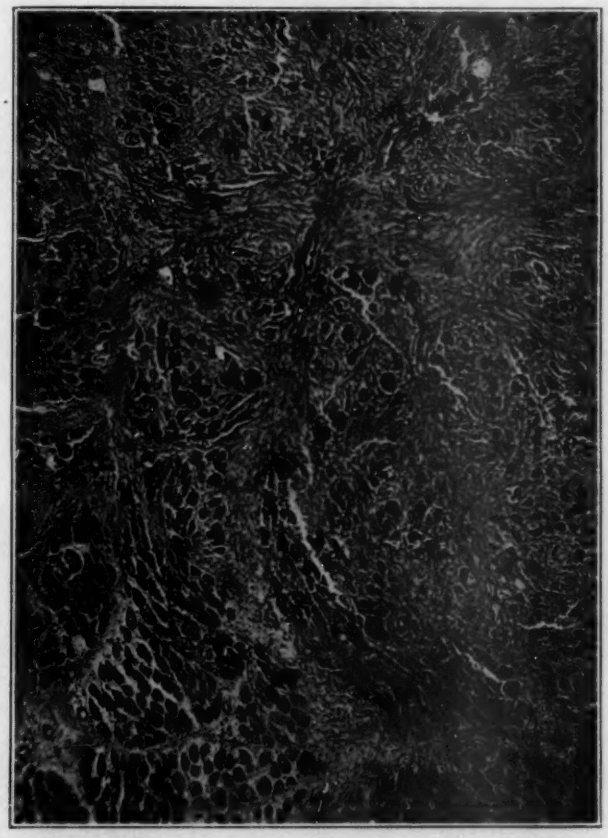

Fig. 1.—Section of biopsy specimen obtained in January 1936. The picture is that of nearly healed interstitial myositis.

features of nearly healed interstitial myositis (fig. 1). No specific characteristics were observed, and the pathologist expressed the opinion that the condition was a phlegmonous infiltration of the subcutaneous and the muscular tissue which had originated in the ear, probably via the mastoid. Determination of the calcium content of the blood serum at that time gave values of 13 and 13.4 mg. per hundred cubic centimeters, and the value for the inorganic phosphorus content of the blood was 6.1 mg. These values, especially that for the calcium content, are slightly above normal.

Since then the morbid process has extended over the arms and the shoulders; each new swelling has been followed by a localized hardening. About one month after the biopsy a swelling appeared on the back and was incised at home by the family physician; it was probably a swelling of muscle tissue; it had disappeared six days later. Firm swellings followed by hardening have appeared again and again at different places on the back, the upper part of the arms, the breast and the abdomen and along the muscles.

Physical Examination.—Examination in the pediatric clinic of the University of Amsterdam late in October 1939 showed that the girl kept her head slightly inclined toward the sternum, with slight rotation to the right (fig. 2). She was

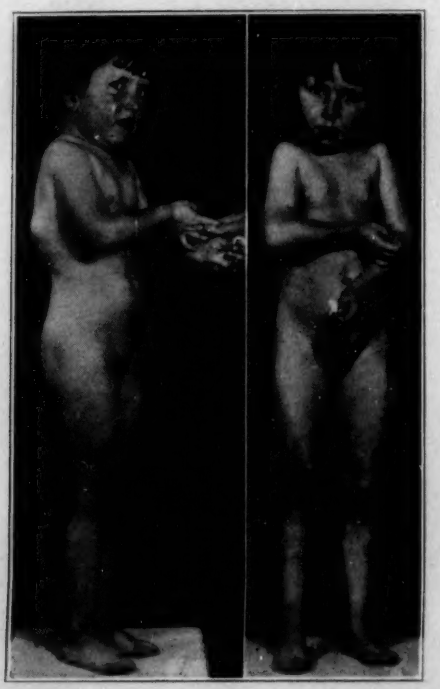

Fig. 2.—Photographs showing the fixed position of the head and the right arm, the small thumbs and big toes and the bony protuberance below the point of the right scapula.

able to nod slightly and to rotate the head. She could arise without aid from a recumbent position. She was good humored and rather intelligent. The auditory function was normal. The skin of the cheeks was shining and glossy. The arms were kept crossed in front of the breast. She was fairly well nourished and not anemic. The head was square with a palpable wall of bone 2 cm. above the arcus superficialis. The eyes and their movements were normal. The musculature of the face was normal. The mouth could not be opened sufficiently to permit thorough examination of the tonsils and the pharynx. The palate was high and the tongue normal; there were some carious teeth. There was a scar on the neck at the site from which the biopsy specimen was obtained. There were

bony thickenings along the lower part of the sternocleidomastoid muscle on both sides, especially in the neighborhood of the scar. The neck was thickened; on palpation it was stiff, almost hard. From the front the thorax appeared rectangular. In the pectoralis major bilaterally were hard areas which were not painful on palpation. The vertebral column showed a thoracic kyphosis. The skin of the lower part of the back was only slightly pliable, and the muscles of the back were so hard and woodlike that the ribs could not be palpated. Below the point of the right scapula was a bony protuberance, fixed to the ribs; on the left side was a similar, smaller mass (exostoses?). In the middle of the back was the small sunken scar of a former incision. The ability to move the vertebral column had nearly completely disappeared. The heart and lungs were normal, as were the abdominal reflexes. On the left side of the abdominal wall was a palpable bony mass extending from the costal margin to just above the iliac crest; on the right side some smaller bony plaques could be felt. The liver was palpable but did not seem enlarged; the spleen was not palpable. The left arm was bent

Fig. 3.—The feet, showing the bilateral hallux valgus, the very short big toes and the nodule (exostosis?) on the right foot.

at the elbow in an angle of about 110 degrees and was fixed in the position of maximal adduction. Slight stretching of the left elbow joint was possible. Along the whole course of both biceps muscles and continuing to the forearm was a thick bony plaque. The forearms and hands, as well as the legs, could still be moved normally, and palpation revealed no abnormalities. Only slight abduction of the right arm was possible; it could be bent at the elbow to an angle of 70 to 90 degrees. The hands were short and broad; the fourth and fifth fingers of both hands were curved; the thumbs were very short, and the second finger was longer than the fourth. Near the right big toe was a bony tumor the size of a pea, not fixed to the bone, which had been present for four months. The big toes were very short, and there was bilateral hallux valgus (fig. 3). Knee and ankle jerks were present.

The roentgenograms of the skeleton (fig. 4), made by Dr. Heilbron, clearly showed the extension of the abnormal extraskeletal bone formation, especially along the muscles of the trunk and the upper part of the arms, with development of ramifications and plaques. The new bone was partially attached to the bones

of the skeleton. As one might expect in view of the microdactylia and the deformities of the great toes, the phalanges of the great toes, the first metacarpal bone on both sides and the middle phalanx of the little fingers were remarkably small and thick (fig. 4*C*). The first metatarsal bone also was thickened. The roentgenograms of the wrists showed retardation in development. Other abnormalities observed roentgenographically were thickening of the frontal bone, a fairly heavy deposit of bone along the muscles of mastication (which has not yet caused

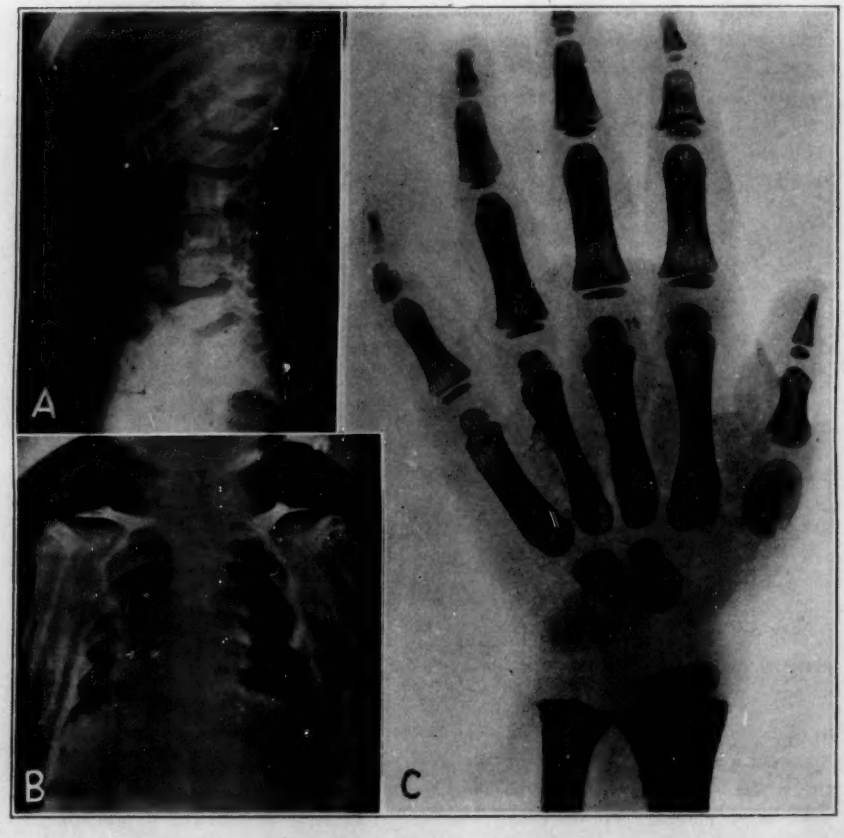

Fig. 4.—Roentgenograms of the trunk (*A* and *B*) and the left hand and wrist (*C*). *A* and *B* clearly show the extraskeletal formation of bone along the muscles of the trunk and the upper parts of the arms, with development of ramifications and plaques; the new bone is partially attached to the bones of the skeleton. *C* shows the retardation in the development of the wrist; the first metacarpal bone and the middle phalanx of the little finger are small and thick.

much interference with chewing), a hook-shaped proturberance from an angle of the jaw, a small exostosis at the proximal metaphysis of the left tibia and in some parts of the skeleton fairly severe osteoporosis.

The respiration was of the abdominal type. The temperature was normal, and there was no coughing or expectoration. Micturition and defecation were normal.

The senses of taste and smell were intact. In walking the girl kept the torso, the head and the arms totally fixed, because of the ossifications and exostoses.

During the patient's six month stay in the pediatric clinic her condition was studied from several different angles and two biopsies were performed.

Laboratory Data.—The specific gravity of the urine was within normal limits, and the daily excretion was normal. The results of tests for albumin, dextrose, urobilin and acetone and the diazo reaction were all negative. Neither the patient nor her parents had porphyrinuria. The reaction of the urine was usually acid. Results of quantitative examinations are given later.

The digestion and consistency of the feces were normal. Oxyuris was present.

The reaction to a Pirquet test was negative. The electrocardiogram showed no abnormalities except slight predominance of the left ventricle. The basal metabolic rate could not be determined in the usual way because the patient was unable to open her mouth sufficiently.

There were no morphologic abnormalities of the blood cells. Serologic tests for syphilis gave negative results for both the patient and the parents. Coagulation time and bleeding time were normal. The alkali reserve was 45.5 volumes per cent. Two dextrose tolerance tests performed after the ingestion of 27 Gm. of dextrose, or 1.5 Gm. per kilogram of body weight, gave normal values for fasting blood sugar (89 and 98 mg. per hundred cubic centimeters) but the curves were somewhat prolonged. The maximal rise was normal the first time (133 mg.) but the second time was too high for the age of the patient (172 mg.). There was no excretion of sugar or acetone in the urine after either test.

The total protein content of the plasma was normal, being 6.84 Gm. per hundred cubic centimeters, of which 4.88 Gm. was albumin, 1.3 Gm. was globulin and 0.66 Gm. was fibrinogen (slightly above normal). The sedimentation rate of the erythrocytes was normal, as were the levels of urea and cholesterol. The sodium content of the serum was 309 mg. per hundred cubic centimeters. The cholinesterase content of the serum was normal (4.1 units per hundred cubic centimeters). Of three reactions to the Takata-Ara test, one was positive and two negative. Two galactose tolerance tests, in which 25 Gm. of galactose was given, showed excretions of 0.48 and 1.9 Gm. (moderately increased). A phenolsulfonphthalein test showed 70 per cent excretion. The urea clearance was normal.

Some features of this case warrant comment. The patient is a girl, while the disease occurs more frequently in boys. The disease began at the age of about 1½ years; in some other cases, some symptoms of the disease, apart from congenital abnormalities, were present at birth or appeared in the first weeks of life. Usually, however, the first symptoms appeared during the first few years of life, but sometimes they began later on in childhood or, very rarely, in adult life.

Unlike some reported cases, there was no history of heredity of the disease in this case, with the exception of the congenital abnormality of the thumbs.

It is customary to try to relate the disease to a preceding infection or trauma. The first symptoms have been observed after many greatly varying infectious diseases but apparently no such direct relation existed

in our case, and there was no history of rheumatic infection, disease of the central nervous system or trauma.

As in most cases, one of the first muscles in which the process became manifest was the sternocleidomastoid. The heart, diaphragm, tongue, larynx and sphincters have thus far remained free. The abdominal muscles are much more affected in our case than is usual. The absence of congenital abnormalities also is unusual; abnormalities, such as spina bifida or absence of the lobules of the ears or of some of the teeth, are rarely absent. Our patient did not complain of any pain, but it is evident from the literature that patients with a later stage of the disease often suffer pain and have difficulties of various kinds. The respiration in particular can present great difficulties because of the progress of the disease in the respiratory muscles, which may lead to an increased susceptibility to infections of the respiratory tract, including tuberculosis, with early death as a consequence. On the other hand, the process may stand still for a considerable time, and even distinct regressions of the osseous process have been observed. It is features such as these which make it difficult to judge the efficacy of therapy.

The recognition of myositis ossificans may present great difficulties in the beginning (see, for example, the second case of Uehlinger and both cases of McCune [4]), but the fully developed form of the disease in a patient of adult age is well known from many descriptions. In the advanced stage of the disease the differential diagnosis from calcinosis universalis progressiva was the only one which had to be considered in our case. Both diseases affect primarily the interstitial connective tissue. The changes in the muscle in myositis ossificans progressiva are only secondary (the ossification of the fascia is primary while that of the tendons and bands is more advanced), while in calcinosis universalis progressiva the hyperplasia of the connective tissue is followed by impregnation with calcium salts. In myositis ossificans progressiva primary calcification never occurs; there is a gradually progressing ossification, sometimes with the formation of cartilage as an intermediary stage. Roentgenologically, therefore, the two diseases are entirely different. In the differential diagnosis the absence of calcification as a primary symptom is the most important argument in favor of the diagnosis of myositis ossificans progressiva next to the presence, in the majority of the cases, of congenital anomalies of the fingers and toes (Sterren,[5] Versé [6]).

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4. McCune, D. J.: Progressive Myositis Ossificans (Progressive Ossifying Fascial Hyperplasia), Am. J. Dis. Child. **59**:446 (Feb.) 1940; **60**:751 (Sept.) 1940.

5. van der Sterren, H. A.: Calcinosis Interstitialis Progressiva, Maandschr. v. kindergeneesk. **3**:396 (July) 1934.

6. Versé, M.: Ueber Calcinosis interstitialis, Beitr. z. path. Anat. u. z. allg. Path. **53**:212, 1912.

Of late a relation between the two diseases has been more frequently accepted. The general opinion of the advocates of this concept is that in both diseases a primary developmental disturbance is present in combination with a derangement of the calcium metabolism, the nature of

Fig. 5.—Section of biopsy specimen obtained in March 1940. For a detailed comment see text.

which is not known. This last-mentioned peculiarity leads in some cases to the development of bony masses with real bone structure (myositis ossificans progressiva) and in other cases causes abnormal deposits of calcium salts (calcinosis universalis progressiva).

Biopsies.—The results of a biopsy are of course dependent on the stage to which the disease has advanced at the site from which the specimen is taken. On March 6, 1940, four years after the first biopsy, Dr. J. P. Backer, with the use of local anesthesia, removed a piece of "muscle tissue" from the left side of the lower part of the back, directly adjoining a bony plaque in the muscle. This tissue was remarkably pale and not abnormally firm; it contained 0.186 per cent glycogen and practically no creatinine (determinations were made by the method of Rose, Helmer and Chanutin [7]). These results did not point to great functional activity of the muscle from which the specimen was removed.[8]

The microscopic examination was performed by Dr. Leusden, and the slides were also examined by Professor Deelman, who made the accompanying photomicrograph (fig. 5). The appearance of the specimen differed greatly from that of the tissue removed in 1936. However, no cartilaginous or osseous tissue was observed (whether such tissue is present, of course, depends on the place from which the specimen is obtained). There were large areas of tissue rich in cells and blood vessels where there was no trace of the original tissue structure. In the connective tissue were numbers of cells in a syncitium-like arrangement. These cells had a fibrillar structure, gave a positive reaction to stains for glycogen and did not stain red in Van Gieson preparations. They contained one large nucleus, and sometimes more than one. These nuclei showed a beautiful chromatin design and a single nucleolus. The nature of these cells could not be ascertained (myogenic elements or young connective tissue cells?). Distinct striation was absent; so we were unable to determine whether these were compressed muscle fibers or their opposite, young muscle elements, or whether they were connective tissue cells with the function of osteoblasts.

Because of the difficulty of judging this piece of tissue we performed another biopsy on March 18; we obtained the specimen from a site somewhat lower than the previous one, and we employed a short narcosis induced by ethyl chloride. The tissue had the color of normal muscle and was not firm. Microscopically it greatly resembled normal muscle (Dr. Leusden). The results of the biochemical examination were in agreement with this observation, for the glycogen content was 0.444 and the creatine content 0.286 per cent. Portions of the tissue were cultured on various mediums by Professor Røuys, but no micro-organisms were recovered, nor were any observed in the sections.

Phosphatase Content of Serum.—The calcium content of the serum was determined four different times; with the exception of the values to be mentioned later, it was normal or slightly increased (once it was 12.9 mg. per hundred cubic centimeters); that of the serum ultrafiltrate was normal. The inorganic phosphorus content of the blood was also normal (4.1 to 4.9 mg. per hundred cubic centimeters).

In a disease such as this, in which abnormal ossification is the predominant symptom, determination of the activity of the serum phosphatase is of great significance in view of the close relation between phosphatase and ossification.

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7. Rose, W. C.; Helmer, O. M., and Chanutin, A.: Modified Method for Estimation of Total Creatinine in Small Amounts of Tissue, J. Biol. Chem. **75**:543 (Nov.) 1927.

8. It is remarkable that determination of the glycogen content of biopsy specimens of muscle from 2 babies in our clinic with amyotonia congenita (Oppenheim's disease) gave values of 0.182 and 0.187 per cent respectively.

Wilkins and associates [9] carried out studies on the phosphatase content of tissues taken for biopsy in a case of progressive myositis ossificans.[10]

In our case the value for the alkaline phosphatase content of the serum, determined by the Bodansky method, was normal (7.5 units per hundred cubic centimeters); other investigators (Burrows,[11] Ellis,[12] Wilkins [9]) have also reported normal values, though in the cases of 2 adults Kajdi [13] found low levels (about 1 unit per hundred cubic centimeters). The "acid" phosphatase content of the serum in childhood has but rarely been determined, but its clinical significance has been emphasized recently by the work of Robinson, Gutman and Gutman [14] and confirmed, in the Netherlands, by that of Müller.[15] They found an increase in the acid phosphatase (measured in King-Armstrong units) in cases of malignant tumors of the prostate with skeletal metastases. Robinson, Gutman and Gutman, as well as Müller, mentioned that 0.5 to 2.4 King-Armstrong units per hundred cubic centimeters was the normal value for adults. The values for our patient, obtained by the same method, were 4.79, 3.1 and 2.95 units, which represent a distinct increase over those obtained for adults. However, determinations for other children have shown that in several childhood conditions not related to the formation of new bone the value for acid phosphatase may be more than 3 units; so one cannot ascribe a special diagnostic value to the results obtained in our case.

Calcium and Phosphorus Balance.—For six days the patient ate a diet containing 974.4 mg. of calcium and 991.8 mg. of phosphorus. During these six days 504.1 mg. of calcium and 104.4 mg. of phosphorus were excreted in the urine. The excretion of calcium was relatively high.

Excretion of Estrogen.—The quantity of estrogen excreted in the urine was very small (determinations were made in the laboratory of Professor Laqueur). Had the patient been older, more significance could have been ascribed to this observation, since in this disease the genital organs are often rudimentary.

Excretion of Creatine and Creatinine.—The excretion of creatine and creatinine in the urine was investigated over a long period. When the patient was put on an

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9. Wilkins, W. E.; Regen, E. M., and Carpenter, G. K.: Phosphatase Studies on Biopsy Tissue in Progressive Myositis Ossificans, Am. J. Dis. Child. **49**:1219 (May) 1935.

10. These workers determined the phosphatase activity of a number of specimens of tissue obtained from a 16 year old girl who had had the disease for nine years. The normal muscle tissue appeared to have little phosphatase activity. In specimens in which muscle and connective tissue were present in about equal quantities but there was no ossification, the phosphatase activity of the connective tissue was much greater than that of the muscle. Bone and cartilage from an older lesion showed a much greater phosphatase activity than a piece of normal rib. These observations, according to the investigators, gave support to the conception that in myositis ossificans progressiva the involvement of the connective tissue is primary.

11. Burrows, H. J.: Case of Progressive Myositis (Fibrositis) Ossificans, Proc. Roy. Soc. Med. **26**:1330 (Aug.) 1933.

12. Ellis, R. W. B.: Osteopetrosis, Proc. Roy. Soc. Med. **27**:1563 (Oct.) 1934.

13. Kajdi, L., in discussion on McCune.[4]

14. Robinson, J. N.; Gutman, E. B., and Gutman, A. B.: Clinical Significance of Increased Serum "Acid" Phosphatase in Patients with Bone Metastases Secondary to Prostatic Carcinoma, J. Urol. **42**:602 (Oct.) 1939.

15. Müller, J.: Over phosphatasen in het serum, Thesis, Amsterdam, 1938; Nederl. tijdschr. v. geneesk. **84**:2431, 1940.

ordinary diet, as well as when she was on a diet free from animal protein, there was a great variation in the daily excretion of both substances; similar variations occur in the majority of cases of muscular dystrophy (Magee).[16] The maximal excretion of creatine in twenty-four hours was 285 mg. and that of preformed creatine 391 mg.

Therapy.—None of the therapeutic methods recommended thus far has had more than transitory success when the process has proceeded to the stage of extensive ossification, and most therapeutic measures have had no effect. In 1937 Tutinjian and Kegerreis[17] recommended the administration of beryllium-carbonate, a substance which causes rickets in rats, probably because the insoluble beryllium-phosphate is formed in the intestine. These workers hoped that by administering this substance to their 23 year old patient with myositis ossificans progressiva the inorganic phosphorus content of the blood could be so lowered that further ossification could be retarded or prevented and, perhaps, the existing abnormal ossifications could be compelled to disappear. A total of 200 Gm. of the preparation was given, in daily doses of 3 to 6 Gm., without success. Perhaps administration at an earlier age and for a longer time would have been successful, but we were unable to obtain the substance.

In those cases in which ossification has not progressed far treatment with a ketogenic diet (Frølich[18]) or roentgen therapy to the affected muscles (Sgalitzer[19]) may be tried. Surgical removal of newly developed bone usually causes temporary improvement of the local condition, but new lesions form.

Administration of Sodium Citrate: Because of the favorable results obtained by Roovers[20] in the case of a girl with calcinosis universalis, we gave our patient daily doses of 3 to 5 Gm. of sodium citrate for several weeks (the use of regular intravenous injections of a calcium compound [Sandoz], which Roovers also gave, was practically impossible in our case). The calcium content of the blood serum during this period of treatment showed only a slight rise; the excretion of calcium in the urine remained practically the same.

Injection of Solution of Parathyroid: There are only a few reports in the literature on the treatment of patients with myositis ossificans progressiva with injections of solution of parathyroid.[21] Theoretically it is possible that injections

16. Magee, M. C.: Creatine and Creatinine Metabolism in Progressive Muscular Dystrophy, Am. J. Dis. Child. **43**:19 (Jan.) 1932.

17. Tutinjian, K. H., and Kegerreis, R.: Myositis Ossificans Progressiva, J. Bone & Joint Surg. **19**:503 (April) 1937.

18. Frølich, T.: La myosite ossifiante progressive, traitée par le jeûne hydrocarboné (l'acidose artificielle), Acta pædiat. **5**:294, 1926; Two Cases of Myositis Ossificans, Norsk mag. f. lægevidensk. **99**:440 (April) 1938.

19. Sgalitzer, M.: Ueber Röntgenbehandlung eines Falles von Myositis ossificans progressiva, Fortschr. a. d. Geb. d. Röntgenstrahlen **54**:304 (Sept.) 1936.

20. Roovers, J.: Calcinosis universalis, Acta med. Scandinav. **100**:57, 1939.

21. It is highly improbable that the moderately increased calcium content of the serum present in some cases, including ours, points to the existence of hyperparathyroidism when the accompanying biochemical symptoms (a low level of inorganic phosphorus and a high level of alkaline phosphatase in the blood) are lacking. For practical reasons (the ossifications) exploration of the parathyroid glands in our case could not be performed. The Hamilton-Schwartz test for the demonstration of increased parathyroid secretion in the blood gave negative results in both cases mentioned by Kajdi.[18]

of the substance might mobilize calcium from the existing ossifications and thus exert a favorable influence on the morbid process. The table summarizes the data on the quantities of the substance injected, the level of calcium in the serum and the excretion of calcium in the urine.

On January 23 roentgen examination of the upper part of the right arm showed that the ossifications were unchanged. From the table it appears that the calcium content of the serum after a number of injections did not show any important rise, although the quantity of solution of parathyroid injected was increased. The excretion of calcium in the urine was practically uninfluenced by the injections; neither the level of inorganic phosphorus of the blood nor that of alkaline phos-

Effect of Injections of Solution of Parathyroid on Calcium Content of Blood Serum and Urine*

Date December 1939	Dose of Solution of Parathyroid, Units	Calcium Content of Blood Serum, Mg. per 100 Cc.	Date December 1939	Calcium Content of Urine, Mg.
7	10	....	7- 9	168
9	10			
11	10	....	9-11	226.6
13	10	....	11-13	254
15	15	17.7	13-15	201
18	10	....	15-17	182.3
20	10	....	17-20	314
22	20	12.4		
26	20			
28	20	Dec. 29 18.8	26-28	157.5
30	30	....	31-Jan. 1	195.0
January 1940			January 1940	
2	20			
4	40	....	2- 4	188.8
6	40	12.8	4- 6	200
9	40			
11	40			
13	40			
15	60	....	13-15	223
17	60	11.8		
19	60	....	18-20	247
22	60	....	20-21	109
			22-24	137
			24-26	203.7
			26-28	204.6

* On January 18 the level of inorganic phosphorus in the blood was 4.1 mg. and that of alkaline phosphatase 5 Bodansky units per hundred cubic centimeters.

phatase showed an increase at the conclusion of the series of injections. The effect of the injections on the calcium content of the serum in our case greatly resembles that observed in cases of Albers-Schönberg disease (Ellis [12]) and the results obtained in animal experiments (Pugsley and Selye [22]). It appears from the experience with our patient that the continued injection of solution of parathyroid, even in large quantities, causes a certain immunity to this substance (though according to Thomson, Collip and Selye [23] there is no reason to believe that in the

22. Pugsley, L. I., and Selye, H.: Histological Changes in Bone Responsible for Action of Parathyroid Hormone on Calcium Metabolism of Rat, J. Physiol. **79**:113 (July) 1933.

23. Thomson, D. L.; Collip, J. B., and Selye, H.: Glandular Physiology and Therapy: The Anti-Hormones, J. A. M. A. **116**:136 (Jan. 11) 1941.

case of parathyroid preparations an antihormone is produced), so that further injections may even lead to increased deposition of calcium. Consequently a primary increase in parathyroid secretion (hyperparathyroidism) in myositis ossificans progressiva seems highly improbable.

Administration of Vitamin B_1: The sensational recent communications on the effect of preparations of vitamin E on the nervous system and on the skeletal musculature induced us to treat our patient for a long time with such preparations. The effect of vitamin E on the metabolism of the muscles is probably secondary. In favor of this conception are the results of animal experiments; in rats which were fed a diet poor in vitamin E and subjected to nerve section the muscular degeneration did not occur on the side of the body where the great sciatic nerve had been cut (Pappenheimer and Goettsch [24]). The disease process in myositis ossificans progressiva is quite different from that in most of the myopathies, but the abnormalities in the metabolism of muscle which we observed greatly resemble those characteristic of some muscular diseases. Moreover, a primary nervous cause for myositis ossificans progressiva cannot be excluded.

During part of the period in which our patient received vitamin E she also received a preparation of vitamin B_1 (a freshly prepared yeast extract). No effect on the disease was observed from the administration of vitamin E, which was given in the form of fresh dried wheat germ (three daily doses of 10 to 20 Gm.), as oil of wheat germ (Organon), which had a varying content of alpha-tocopherol (finally, the daily dose of oil equaled 72 mg. of tocopherol) and as tablets of tocopherol (1 tablet three times daily, or 3 Gm.).

Administration of Disodium Hydrogen Phosphate (Na_2HPO_4): Because of the favorable results obtained in several cases of calcinosis universalis [25] with disodium hydrogen phosphate, our patient for a long time received a daily dose of 6 Gm. of the substance, but no influence from its administration on the general condition or on the calcium and phosphorus metabolism could be established.

Low Calcium Diet: Beginning May 9, 1940, the patient was put on a diet poor in calcium; this caused a considerable diminution in the daily excretion of calcium in the urine. The effects of this diet had not been established when the child was discharged from the clinic, on May 26. The diet was continued at home for a long time. A roentgenogram of the thorax and the upper part of the right arm taken in April 1941 showed that the extraskeletal bone formation had slightly increased. The appearance of the skeletal bones showed no change from that of one year before.

With a diet free from animal protein, creatine, as was previously mentioned, was present in the urine; the various therapeutic measures, and the administration of the preparations of vitamin E in particular,[26] had no effect on the quantity of creatine and creatinine excreted.

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24. Pappenheimer, A. M., and Goettsch, M.: Effect of Nerve Section upon Development of Nutritional Muscular Dystrophy in Young Rats, Proc. Soc. Exper. Biol. & Med. **43**:313 (Feb.) 1940.

25. Rothstein, J. L., and Welt, S.: Calcinosis Universalis and Calcinosis Circumscripta in Infancy and Childhood, Am. J. Dis. Child. **52**:368 (Aug.) 1936.

26. Verzár, F.: Der Kreatin-Stoffwechsel bei der Muskeldystrophie durch E. vitaminmangel und seine Beeinflussung durch α-Tocopherol, Ztschr. f. Vitaminforsch. **9**:242, 1939.

SUMMARY

The results of extensive clinical and roentgenologic studies of a girl with progressive myositis ossificans are reported. Biopsies were performed in two different stages of the disease, and the results of the histologic and microchemical investigations are given. The metabolism of muscle was studied from several different angles in order to gain insight into the pathologic physiology of the disease. A number of types of therapy, some of which were based on recent studies, were tried, with disappointing results. The outcome of treatment with a preparation of parathyroid is communicated. After several injections of the substance the calcium content of the serum no longer showed any important increase above normal.

HYPERLIPEMIA

"IDIOPATHIC LIPEMIA"

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So-called idiopathic lipemia is extremely rare. The clinical histories of but 5 patients have been reported in the literature. The present case is the sixth to be recorded and, as far as can be determined, is the first to include the results of a postmortem examination. A clinical report of this case has been published by Goodman, Shuman and Goodman.[1]

REPORT OF A CASE

History.—W. R., a Gentile male infant, was first seen at the age of 1 year in the pediatric service of the Boston City Hospital, on April 10, 1939. He was brought to the hospital because of a purulent discharge from the left ear, of one month's duration, and failure to gain weight. The family history was not remarkable. The father, mother, 3 sisters and 1 brother were living and in good health. There was a history of 1 stillbirth, and 1 sibling, aged 3 months, had died of pneumonia.

The patient was born normally at full term. The birth weight was 7 pounds (3,175 Gm.). The mother's antepartum diet was adequate. The patient was breast fed for two weeks and then was given a formula of whole milk, water and Karo syrup. At the time of entry to the hospital the daily diet consisted mainly of 1 quart (946 cc.) of milk and 3 teaspoons of cod liver oil. No fruit or vegetables were included in the diet.

First Hospitalization.—Physical Examination: The infant appeared to be well developed but poorly nourished. He seemed to be mentally alert but was unable to crawl or sit up without assistance. He weighed 15 pounds (6.8 Kg.). The temperature and the pulse and respiratory rates were normal. The frontal bosses were prominent. The anterior fontanel was patent, and the posterior fontanel was closed. There were no cutaneous lesions, but there were a few discrete yellowish white papular lesions over the hard palate. The costochondral junctions were enlarged. There was a profuse, bilateral, purulent nasal discharge. The left auditory canal was filled with thick, yellow-green purulent material, and the right ear drum was retracted. The remainder of the physical and the neurologic examination gave entirely negative results.

Laboratory Data: The following laboratory data were obtained. The hemoglobin content was 11.4 Gm. per hundred cubic centimeters; the red blood cell count

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From the Mallory Institute of Pathology, Boston City Hospital.

1. Goodman, M.; Shuman, H., and Goodman, S.: Idiopathic Lipemia with Secondary Xanthomatosis, Hepatosplenomegaly, and Lipemia Retinalis, J. Pediat. **16**:596-606, 1940.

was 4,450,000 and the white blood cell count 13,600 per cubic millimeter, with 52 per cent polymorphonuclear leukocytes, 40 per cent lymphocytes, 7 per cent monocytes and 1 per cent eosinophils. The morphologic characteristics of the red and white blood cells did not appear to be abnormal. Examination of the urine revealed nothing of significance. The stool contained fat but no blood or starch. The fasting blood sugar was 70 mg. and the nonprotein nitrogen content of the blood 26 mg. per hundred cubic centimeters. The Schick, Dick and Mantoux reactions and the result of a Hinton test of the blood were negative. A hemolytic strain of Streptococcus, Haemophilus influenzae and Micrococcus catarrhalis were recovered from cultures of material from the nose and Staphylococcus aureus, a hemolytic strain of Streptococcus and H. influenzae from cultures of material from the ear. Roentgenograms of the chest and the long bones were normal.

In the course of the routine serologic examinations the blood serum was noted to be milky white. A determination of total fatty acids on a sample of blood obtained during fasting was 1,900 mg. per hundred cubic centimeters (normal, 440 mg.). Since the child was discharged at this time, no other lipoid studies were made.

Course: A roentgenogram showed the presence of ethmoid sinusitis. Adenoidectomy was performed, after which there was gradual disappearance of the aural discharge. The nasal discharge cleared up with nasal irrigations. The child gained 2 pounds (907 Gm.) during the two and a half months' stay in the hospital.

Second Hospitalization.—Approximately five weeks after discharge from the hospital the mother noticed a few "raised pimples" over the chin, the buttocks and the thighs, which she thought were painful to the child when sitting. Because the cutaneous lesions persisted, the child was readmitted to the hospital on September 6, ten weeks after the first hospitalization. The child had ganied weight on an adequate and varied diet and now weighed 19 pounds (8.6 Kg.). There was no evidence of the previous sinusitis and otitis media. Four teeth had developed. The skin showed discrete, circular and oval, umbilicated papular lesions, measuring from 2 to 6 mm., on the lower jaw, the ears, the thighs, the scrotum, the buttocks and the eyelids. There were many small yellow papules on the hard palate. Examination of the eyegrounds revealed lipaemia retinalis.

The liver and the spleen were palpable 2 fingerbreadths below the costal margin. The remainder of the physical examination revealed nothing of note.

The total fatty acids of the blood measured 3,115 mg. per hundred cubic centimeters on admission. The child was given a regular diet for one week, with no change in the appearance of the lesions. He was then placed on a low fat diet consisting of skimmed milk, vegetables, bread and stewed fruits. No cod liver oil or butter was given. During the next four weeks the value for total fatty acids in the blood dropped to 1,311 mg. per hundred cubic centimeters, and the cutaneous lesions on the buttocks, the scrotum and the jaw gradually cleared. There was a decrease in the number of lesions on the hard palate. In addition, the spleen and the liver decreased in size. Biopsy of a cutaneous lesion performed shortly after admission showed secondary xanthoma; the results are described in detail later.

Third Hospitalization.—The child was discharged on October 10, with instruction to the family to continue feeding the low fat diet at home. He was admitted to the hospital again on November 22, because of a profuse mucopurulent nasal discharge. The cutaneous lesions had receded to small, discrete yellow papules, and the liver and spleen were not palpable. Lipaemia retinalis was still present.

The sinusitis gradually improved with symptomatic treatment, and the child was discharged on December 14.

Fourth Hospitalization.—On Jan. 23, 1940 he was again admitted, because of an infection of the upper respiratory tract with profuse nasal discharge, cough and occasional vomiting. The temperature was slightly elevated but dropped to normal on the second day in the hospital. Physical examination at this time showed no evidence of the former cutaneous lesions except for a small xanthoma on the right lower eyelid. There was a postnasal discharge. The liver was enlarged and was palpable 3 fingerbreadths below the right costal margin. The edge of the spleen was barely palpable. The remainder of the physical examination gave essentially negative results.

On the fourth day of hospitalization the child became irritable, and nausea and vomiting were frequent. He was unable to retain fluids, and his temperature rose to 100.1 F. His hands and feet became cold and clammy, and he died suddenly on that day, at the age of 21 months.

Summary of Laboratory Data.—The laboratory studies summarized below were carried out during the different periods of hospitalization. The hemoglobin content varied between 60 and 70 per cent (Sahli), and the red blood cell count ranged from 3,500,000 to 4,300,000 and the white blood cell count from 5,100 to 22,000 per cubic millimeter. Differential counts showed 44 to 60 per cent polymorphonuclear leukocytes, 40 to 50 per cent lymphocytes, 3 to 4 per cent mononuclears and 3 to 8 per cent eosinophils. The red and white blood cells were normal in size and appearance. The platelets numbered 179,000 per cubic millimeter.

The results of various tests of the urine were negative. The specific gravity varied from 1.010 to 1.020, and no albumin, casts or blood cells were observed.

Examination of the stools also gave negative results. Fat and starch were present in normal amounts. No parasites were observed, and no occult blood was present.

The fasting blood sugar levels were 85, 90, 70 and 100 mg. per hundred cubic centimeters. A dextrose tolerance test, in which 2 Gm. of sugar per kilogram of body weight was administered, gave the following curve: after thirty minutes, 90 mg. of dextrose per hundred cubic centimeters of blood; after one hour, 129 mg.; after two hours, 110 mg., and after three hours, 100 mg.

The level of nonprotein nitrogen in the blood was 27 mg. per hundred cubic centimeters; of total protein, 6.5 Gm.; of calcium, 9.8 mg.; of phosphorus, 5.6 mg., and of phosphatase, 2.75 Bodansky units. The icteric index was 8, and the carbon dioxide-combining power of the blood was 46 volumes per cent.

One cubic centimeter of blood amylase hydrolyzed starch solution to yield 2.33 mg. of maltose in one hour. Of the blood enzymes, monobutyrinase gave 11 per cent splitting of 0.15 cc. of monobutyrin, tributyrinase 5 per cent splitting of 0.1 cc. of tributyrin and lipase no splitting of 0.25 Gm. of olive oil.

Roentgenograms of the long bones were normal. Those of the skull showed a normal sella turcica. Fluoroscopic examination of the stomach and the duodenum gave negative results.

A lumbar puncture showed normal dynamics and clear spinal fluid which contained no cells. The results of tests for sugar and for total protein were negative.

To summarize, the patient was suffering from unexplained lipemia with hepatosplenomegaly, lipaemia retinalis and xanthomatous cutaneous lesions. The level of total blood cholesterol was elevated but there was a normal free cholesterol-

cholesterol ester ratio. The level of phosphatase in the blood was normal, but no lipase was present in the serum. On admission the determination for sphingomyelin in the blood was below normal, and no cephalin was found in the blood. After a low fat diet had been consumed for one month the level of cephalin in the blood was only slightly below normal and that of sphingomyelin remained low. The lecithin content of the serum, which was three times greater than normal on admission, showed a marked decrease after the low fat diet had been instituted. These determinations are summarized in table 1.

Postmortem Examination.—Autopsy was performed five hours after death.

Gross Examination: The body was that of a normally developed, fairly well nourished white male infant. No cutaneous lesions were present. The serous cavities were normal. The heart was of the usual size and appearance. The lungs were increased in weight, the right weighing 110 Gm. (normal, 82 Gm.) and the left 90 Gm. (normal, 75 Gm.). They showed a moderate amount of congestion and edema. The liver and the spleen were enlarged, the liver weighing 410 Gm. (normal, 375 Gm.) and the spleen 49 Gm. (normal, 30 to 33 Gm.).

TABLE 1.—*Results of Examinations on the Blood* Before and After Institution of Fat-Restricted Diet*

	Before Fat-Restricted Diet	After Fat-Restricted Diet
Total cholesterol	379.0	330.0
Free cholesterol	158.5	114.7
Cholesterol ester	220.5	215.3
Total phospholipids	465.0	368.0
Sphingomyelin	12.6	12.1
Cephalin	None	60.0
Lecithin	452.4	295.9
Total fatty acids	3,115.0	1,900.0

* Results are expressed in milligrams per hundred cubic centimeters of serum.

Otherwise, they were of the usual appearance. The pancreas weighed 25 Gm., the kidneys 90 Gm., the adrenal glands 65 Gm. and the thyroid 3 Gm.

Microscopic Examination: The lungs showed serum coagulum in scattered alveoli. The alveolar capillaries were engorged.

There were many fat-containing cells scattered throughout the spleen (fig. 1), which varied from 8 to 34 microns in diameter. The great majority were in the pulp of the spleen, although an occasional one was found in the sinusoids. They bore no apparent relation to the germinal centers, and there was no cellular reaction of any kind around them. The fat substance in the cells took the form of droplets, which varied greatly in size. In some of the cells, particularly the larger ones, these droplets of lipoid material were minute and so closely packed together that the cells had a finely reticulated and foamy appearance. In sections stained with aniline blue the periphery of the droplets tended to take the stain. In the larger group of smaller cells the lipoid substance was usually present in the form of a few large globules. The lipoid substance varied in the manner in which it stained with sudan III and nile blue, some staining well, while that in other cells and, in some instances, in the same cell took the stains poorly or not at all. When the nile blue was taken up by the material the resultant coloration ranged from delicate rose to red. Double refractile crystals suggesting cholesterol were demonstrated with the polarizing microscope in the cytoplasm of both the

large and the small cells. The nuclei of the cells were small, round or oval and finely reticulated and were usually eccentric. Many of the center arterioles of the germinal centers of the spleen contained considerable fat in their walls, which was demonstrated by the sudan IV stain. This fat was not apparent in the sections stained with phloxine and methylene blue (fig. 1).

Cells similar in all respects to those in the spleen were present in the vertebral marrow. Here the larger cells were more numerous than in the spleen. As in the spleen, the cells apparently were not associated with any particular structure,

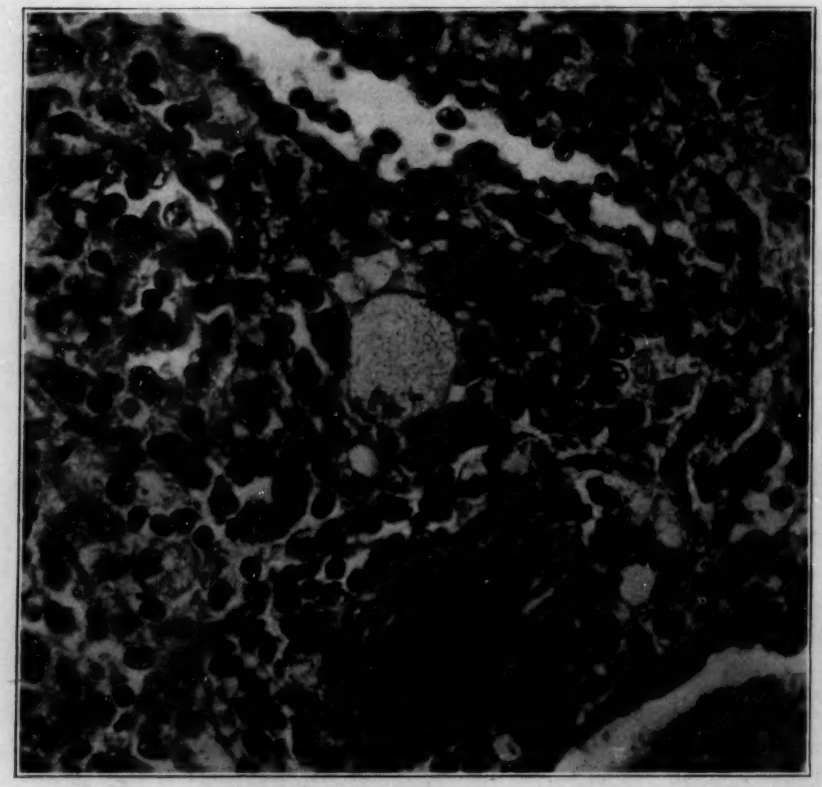

Fig. 1.—Section of spleen, with lipoid-containing cell. Phloxine–methylene blue stain; × 600.

and there was no cellular reaction of any type around the lipoid-laden cells. The marrow otherwise showed normal activity in both the red and the white cell series (fig. 2).

In the lymph nodes there were a few scattered fat-containing cells similar to those in the spleen and the bone marrow.

The pancreas appeared normal. The liver showed slight central congestion and scattered small areas of acute focal necrosis with infiltration by polymorphonuclear leukocytes. No foam cells were seen in the liver. Examination of the kidneys, the thyroid and the parathyroids showed no abnormalities.

The examination of a specimen taken for biopsy from one of the cutaneous lesions at the time of the second admission showed that the corium was infiltrated by large foam cells. In one small area these cells caused a definite nodular thickening of the tissue. This area was infiltrated by polymorphonuclear leukocytes. The pathologic picture was consistent with that of xanthoma and acute dermatitis.

Comment on the Case.—No adequate cause of the child's sudden death was found at necropsy. Unfortunately, permission for exam-

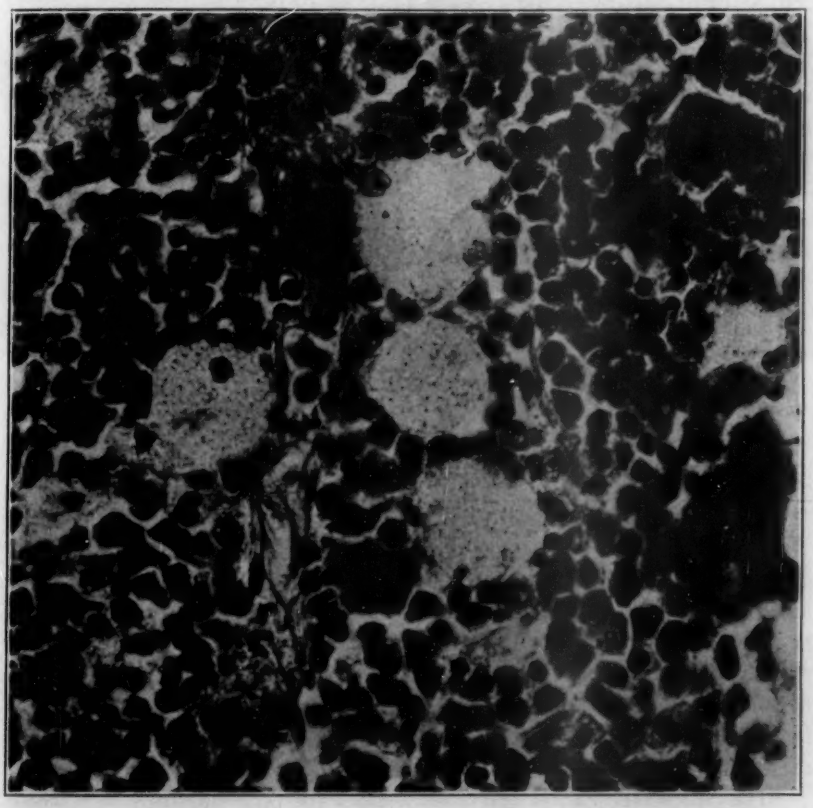

Fig. 2.—Section of bone marrow, showing lipoid-containing cells. Phloxine-methylene blue stain; × 600.

ination of the central nervous system was not granted. The outstanding feature of the autopsy was the almost total lack of histologic evidence of abnormal lipoid deposits in the organs or in the reticuloendothelial system. Scattered fat-containing cells, such as were previously described, were observed in the bone marrow, the lymph nodes and the spleen. Similar cells were found in sections of the biopsy specimen taken from one of the xanthomatous cutaneous lesions previously described. Such cells were not found in the liver, the pancreas, the lungs, the lymph

nodes or other organs. This observation was corroborated by the results of chemical analysis of the liver. The values for the concentrations of the following substances in the liver and the blood serum were determined: total cholesterol, free cholesterol, cholesterol ester, total phospholipid, sphingomyelin, cephalin, lecithin and total lipoid fatty acids.

As can be seen from table 2, there was no significant increase in the lipoid content of the liver, the value for total fatty acids being 9.45 per cent as contrasted with the average value of 10 per cent.

There was no gross or microscopic evidence of pancreatic disease. This tends to disprove suggestions that hyperlipemia is associated with pancreatitis. There were a few scattered areas of focal necrosis with infiltration of polymorphonuclear leukocytes in the liver, but there was no evidence of biliary cirrhosis or of serious hepatic damage.

TABLE 2.—*Lipoid Content of Blood Serum and Liver* *

	Serum, Mg. per 100 Cc.		Liver, Percentage of Dry Weight	
	Present	Normal	Present	Normal
Total cholesterol	370.0	150 - 230	2.52	2.0 - 3.0
Free cholesterol	99.4	35 - 60	0.73	0.4 - 0.6
Cholesterol ester	270.6	120 - 170	1.79	1.5 - 2.2
Total phospholipid	375.0	172 - 275	10.05	9.0 -11.0
Sphingomyelin	50.0	15 - 35	1.44	0.3 - 0.45
Cephalin	162.0	50 - 130	3.05	3.0 - 5.5
Lecithin	163.0	50 - 200	5.56	3.5 - 5.7
Total lipoid fatty acids	1,070.0	200 - 400	9.45	8.0 -11.0

* The determinations were made by Dr. S. J. Thannhauser and Dr. Harold Reinstein.

The occurrence of hyperlipemia has been described in cases of chronic anemia and leukemia, but studies on the bone marrow and the blood did not show any evidence of blood dyscrasia in this case.

The thyroid was of normal size and appearance, and there were no histologic indications of disease. There was no sign of atheroma in the blood vessels, nor was there roentgen or gross evidence of disease of the bones.

The cutaneous lesions described were of the type classified by Thannhauser and Magendantz [2] as characteristic of secondary, or eruptive, xanthomatosis. Histologically such lesions differ from those of primary xanthomatosis in that no granulation tissue or giant, that is, so-called Touton, cells are present. In addition, fewer foam cells are found in the lesions of essential xanthomatosis. The foam cells present are large and

2. (*a*) Thannhauser, S. J., and Magendantz, H.: The Different Clinical Groups of Xanthomatous Diseases: A Clinical Physiological Study of Twenty-Two Cases, Ann. Int. Med. **11**:1662-1746, 1938. (*b*) Thannhauser, S. J.: Lipidoses: Diseases of the Cellular Lipid Metabolism, in Christian, H. A.: Oxford Medicine, New York, Oxford University Press, 1940, vol. 4, chap. 7A, p. 214.

contain small, deeply staining round nuclei surrounded by finely vacuolated cytoplasm, which gives it its characteristic foamy appearance. This cytoplasm does not take the ordinary stains but will stain with sudan IV. It is noteworthy that secondary xanthomatosis is associated with hyperlipemia and may disappear entirely if the hyperlipemia improves. So-called essential xanthomatosis is not associated with hyperlipemia and, when once present, tends to remain permanently.

"Idiopathic lipemia" is distinguished clinically from the hyperlipemia occasionally present in cases of von Gierke's disease in that in the latter only the liver is enlarged and the spleen is of normal size. In addition, patients with von Gierke's disease have an abnormal sugar tolerance and abnormally low blood sugar. The levels of lipids in the serum may be the same in the two diseases. At necropsy the absence of glycogen deposits in the organs in cases of "idiopathic lipemia" readily distinguishes the two conditions.

Of the diseases due to disturbances of lipoid metabolism, Niemann-Pick disease is probably the most difficult to distinguish from "idiopathic lipemia." Hyperlipemia is commonly present in Niemann-Pick disease, and the distribution of serum lipids may be similar. Niemann-Pick disease usually affects females of the Jewish race and appears to be a congenital constitutional and familial disorder. It begins in the early months of life, with enlargement of the liver and the spleen. Pick [3] described a rapid enlargement of the abdomen, moderate to marked enlargement of the superficial lymph nodes, pale and yellowish brown discoloration of the exposed parts of the skin, slight ascites, edema and bronchitis as constant signs. Large vacuoles may be present in many lymphocytes and polymorphonuclear leukocytes. The level of cholesterol in the blood is usually markedly elevated. The clinical course is fulminating, with general cachexia and death by the second year of life. The clinical course of "idiopathic lipemia" is benign, and apparently the disease is not inconsistent with a normal life span, for in the 5 cases reported the patients' ages range up to 15 years. While the reported cases are too few to permit generalizations, it appears that there is no racial or sex predilection in the persons affected. In "idiopathic lipemia" there is not the massive enlargement of the abdomen and the lymph nodes, the discoloration of the skin, the ascites, the edema and the bronchitis described as characteristic of Niemann-Pick disease.

Studies on the blood in the case reported by Holt and associates [4] and in our case did not show vacuolation of the lymphocytes and leukocytes, a point of some diagnostic importance. If necessary, it should be

3. Pick, L.: Niemann-Pick's Disease and Other Forms of So-Called Xanthomatosis, Am. J. M. Sc. **185**:601-616, 1933.

4. Holt, L. E., Jr.; Aylward, F. X., and Timbres, H. G.: Idiopathic Familial Lipemia, Bull. Johns Hopkins Hosp. **64**:279-314, 1939.

possible to establish the diagnosis by biopsy of the bone marrow or of an enlarged lymph node or by splenic puncture and the consequent demonstration of the presence or absence of the typical large cells of Niemann-Pick disease. Pick stated that these cells measure 20 to 60 microns in diameter, have a definite and typical honeycomb, or foam, structure and rarely have more than one or two nuclei. The periphery of the cell is usually vacuolated, while the center of the cell body is homogeneous and strongly acidophilic.

Histologic and microchemical studies of the organs in cases of Niemann-Pick disease show widespread distribution of lipoids in the form of phosphatides in the reticuloendothelial system and in the epithelial cells of the kidney, the thyroid, the thymus, the liver, the lungs and the adrenal glands, to name but a few of the organs which may be involved. There are tremendous numbers of large pale cells similar to those found on splenic puncture. Such a widespread distribution of fat was not seen in the present case.

The characteristic triad of (1) bone defects, particularly of the skull, (2) exophthalmos and (3) diabetes insipidus, which is characteristic of Hand-Schüller-Christian disease, is not present in "idiopathic lipemia." The levels of fatty acids, phosphatides and cholesterol in the blood may be elevated, but true hyperlipemia has not been described in a case of Hand-Schüller-Christian disease.

The observations at autopsy in a case of fully developed Hand-Schüller-Christian disease are those of skeletal disease. The bony changes are most marked in the skull. The bony defects vary in size and shape and are filled by light yellow to brown granulomatous tissue, which may become light yellow fibrous tissue in the later stages of the disease. This granulomatous tissue by involving nearby structures pushes the pituitary upward. The pituitary itself and the surrounding structures are usually light yellow. There may be moderate enlargement of the spleen, the liver and the lymph nodes, as well as other structures containing lymphoid tissue.

Microscopically, the most outstanding feature is the foam cell. This resembles the type seen in secondary xanthoma. The cells vary in size and shape, contain one, two or more small nuclei and are readily stained by nile blue and sudan III. This is due to the high cholesterol content of the cell, an explanation confirmed by chemical analysis of the organs.

The foam cells are widely distributed, and they are usually found associated with the formation of granulation and, later, fibrous tissue. Such lesions are usually most pronounced in the lungs and often result in the obliteration of the alveoli.

In our case there was no granulation or scar tissue, the foam cells were not widely distributed and there was no evidence of involvement of the bones, the pituitary gland or the lungs.

The organs in cases of Gaucher's disease contain large deposits of fat in the form of cerebrosides distributed in the cells of the reticuloendothelial system. This is in marked contrast to the observations in our case, in which only a few scattered fat-containing cells were present. Clinically, the fact that hyperlipemia is not found in Gaucher's disease and the absence of bone lesions in "idiopathic lipemia" serve to differentiate the two diseases.

COMMENT

The first case of hyperlipemia with hepatosplenomegaly was described in 1932, by Bürger and Grütz.[5] This case, that of an 11 year old boy, was similar to the one reported here in that the severity of the hyperlipemia, hepatosplenomegaly and xanthomatosis showed a direct relation to the fat content of the diet, with improvement on a low fat diet. In Opitz's [6] case, that of a 12 year old boy, and in Franklin's,[7] that of a 5 year old girl, there were marked hyperlipemia and splenomegaly but no xanthomatous cutaneous lesions. In the case of Bernstein and associates,[8] that of a 6 year old boy, there was marked hyperlipemia with splenomegaly and slight enlargement of the liver, together with xanthomatosis. Holt and associates [4] reported the case of an 11 year old girl which was studied in great detail. This case was characterized by hyperlipemia and hepatosplenomegaly and was the first reported in which retinal lipemia was associated with hyperlipemia.

The familial incidence of this condition has yet to be determined. The brother of the patient in the case reported by Holt and associates showed a similar condition, with enlargement of the liver and the spleen, lipemic appearance of the retinal vessels and definite increase in the lipid content of the blood. The elevation of the blood lipids was less marked with ingestion of a low fat diet. It is interesting to note the patient's mother showed a slight elevation of the lipids in the blood, although her father and her sister had normal values. In our case there was no family history of disturbance of lipoid metabolism, and studies on the blood revealed no abnormal values. The values for the level of fatty acids in the blood for the members of the patient's family were as

5. Bürger, M., and Grütz, O.: Ueber hepatosplenomegale Lipoidose mit xanthomatösen Veränderungen im Haut und Schleimhaut, Arch. f. Dermat. u. Syph. **166**:542-575, 1932.

6. Opitz, H.: Hochgradige Lipämie unklarer Genese bei einem 12 jahrigen Knaben, Deutsche med. Wchnschr. **61**:88-89, 1935.

7. Franklin, S. M.: Splenomegaly with Lipaemia, Proc. Roy. Soc. Med. **30**: 711, 1937.

8. Bernstein, S. S.; Williams, H. H.; Hummel, F. C.; Shepherd, M. L., and Erickson, B. N.: Metabolic Observations on a Child with Essential Hyperlipemia, J. Pediat. **14**:570-580, 1939.

follows: D. R., 291.0 mg. per hundred cubic centimeters; P. R., 252.2 mg.; E. R., 352.0 mg.; R. R., 218.0 mg.; mother, 356.0 mg., and father, 400.0 mg.

The actual pathogenesis of hyperlipemia is not known. Theories have been advanced, but studies have not been carried out in a sufficient number of cases for any definite conclusions to be reached.

Holt and associates carried out extensive studies in their case. Lecithin, choline, thyroxin, insulin, liver extract and a preparation of the anterior lobe of the pituitary were all given without benefit. The patient was given transfusions, with the thought in mind that her blood was lacking in some principle normally present. After the first transfusion there was a definite drop in the level of fat in the blood. Three other transfusions produced no results. While Holt and his co-workers reached no definite conclusion, they suggested that the hyperlipemia was due to a defective mechanism for removal of blood fat by the liver and that this mechanism was concerned with some humoral factor.

Thannhauser has suggested that the hyperlipemia in our case was due to an improper mechanism of fat deposition. He expressed the opinion that this mechanism was dependent on the fermentative system in the organs of fat deposition and storage. The ferments are the lipases and phosphatases of the fat tissue. Since the amount of lipase and phosphatase in the blood can be considered an index of the concentration and activity of these enzymes in the tissue, absence of these enzymes from the blood would indicate an absence or a decrease of the enzymes in the tissue. In the present case lipase was absent from the blood. If this observation is corroborated in future cases it would be in favor of Thannhauser's suggestion of a deficient fermentative system in the organs of fat deposition and storage.

SUMMARY

The observations at autopsy in a case of hyperlipemia with hepatosplenomegaly, retinal lipemia and xanthomatosis are reported for the first time.

Histologic and chemical examinations showed a remarkable lack of fat deposition in the tissues. This was in striking contrast to the high fat content of the blood serum.

There was noteworthy lack of evidence of disease of the liver, the pancreas, the bones or the thyroid.

Dr. S. J. Thannhauser aided in the preparation of this paper.

PYLORIC STENOSIS IN NONIDENTICAL TWINS

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The occurrence of malformations in twins has always incited the interest of medical observers. In the last two decades such malformations have been of special note in view of the introduction of the theory of genetic pathogenesis of some tumors. The incidence of congenital pyloric stenosis in twins has been a bulwark in the defense of this theory because it has indicated few exceptions to the general axiom that "heterologous twins never suffer from identical malformations, nor does one of homologous twins ever suffer from malformation not shared by its fellow." [1]

There have been many cases to suggest and to give support to the belief that there is a genetic basis for pyloric stenosis, the exact nature of which is not known. The fact that in four fifths of the cases the disease occurs in males attests to that, as does the report of Fabricius and Vogt-Møller [2] on 4 siblings with pyloric stenosis, all of whom had the same mother and 3 the same father. Brindle [3] reported on a baker's family in which 3 brothers and an uncle had this same disease. The same author referred to a laborer's family in which 5 of 10 children died of pylorospasm, the children of the 2 normal sons were normal and the male children of the 3 normal daughters were affected, which rather strongly suggests a sex-linked inheritance. Cockayne [4] reported 2 instances of the occurrence of pyloric stenosis in first cousins.

After a study of previous reports we add the cases of a set of dizygotic twins and of 2 brothers, born two years apart, all of whom were operated on for pyloric stenosis and recovered.

Ford, Brown and McCreary,[5] of Toronto, Canada, suggested that "the environmental handicap imposed before birth on members of multiple sets is one factor inducing the condition of pyloric stenosis." They

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1. McFarland, J., and Meade, T. S.: Am. J. M. Sc. **184**:66, 1932.

2. Fabricius, B., and Vogt-Møller, P.: Hospitalstid. **80**:166, 1937.

3. Brindle, E.: Monatschr. f. Kinderh. **68**:295, 1937; cited by Card, T. A.: J. Pediat. **14**:658, 1939.

4. Cockayne, E. A.: Lancet **1**:898, 1934.

5. Ford, N.; Brown, A., and McCreary, J. F.: Evidence of Monozygosity and Disturbance of Growth in Twins with Pyloric Stenosis, Am. J. Dis. Child. **61**:41 (Jan.) 1941.

based this statement on the fact that the proportion of twins in their group of patients with pyloric stenosis was 1 to 36.3 as compared with the frequency of twin births in Canada of 1 in 83.4. Sheldon [6] made a similar observation in England; his comparable figures were 1 to 43.4 and 1 to 80.

Because of the infrequency of multiple births and of pyloric stenosis the number of reports of the occurrence of this disease in the members of multiple sets have been relatively few, and those published previous to 1925 are of little value because of the lack of knowledge regarding

Data on Cases of Pyloric Stenosis in Twins Reported in the Literature

Author	Type of Twinning	Comment
Cockayne and Sheldon: Proc. Roy. Soc. Med. **21**: 1260, 1928	Homologous	Boys; 1 recovered, 1 died
Bilderback: Northwest Med. **27**: 182, 1928	Homologous	Boys; 1 recovered, 1 died
Sommer: Deutsche Ztschr. f. Chir. **232**: 398, 1931	Homologous	Girls; both recovered
Varden (footnote 8)	Homologous	Boys; 1 recovered, 1 died
Moore: South. M. J. **17**: 187, 1934	Homologous	Boys; both died
de Lange: Arch. Dis. Childhood **11**: 39, 1936	Homologous	Boys; both recovered; maternal aunt had pyloric stenosis
Redgate: Brit. M. J. **2**: 725, 973, 1935	Homologous	Boys; 1 recovered, 1 died
Card (footnote 3)	Homologous	Boys (Mexican); both recovered
Lasch [10]	Homologous	Girls; 1 normal, the other died before operation and autopsy showed pyloric stenosis
Sheldon [6]	Homologous	Boys; 1 normal, the other operated on and recovered
Davis [9]	?	Boys; both recovered
Monrad [7]	?	3 sets; 1 member of each set affected
Redalin [8]	?	2 sets
Sheldon [6]	Heterologous	12 sets; 1 member of each set affected
Ford, Brown and McCreary [5]	Homologous Heterologous	2 sets; all affected; all recovered 9 sets; 1 member of each set affected, all recovered
O'Donnell and Klein	Heterologous	Boys; both operated on, both recovered

the type of twinning. Monrad [7] mentioned the occurrence of pyloric stenosis in 3 sets of twins, Redalin [8] in 2 sets and Davis [9] in 1 set; all of these reports of twins cannot be considered because the type of twinning was not identified. Since the publication of these reports some authentic instances of the occurrence of pyloric stenosis in both members of sets of homologous (monozygotic) twins have been recorded (table).

6. Sheldon, W.: Lancet **1**:1048, 1938.

7. Monrad, S.: Monatschr. f. Kinderh. **37**:473, 1927.

8. Redalin, cited by Varden, A. E.: J. Pediat. **3**:493, 1933.

9. Davis, H. H.: Congenital Hypertrophic Pyloric Stenosis in Twins, J. A. M. A. **83**:686 (Aug. 30) 1924.

The reports of Lasch [10] and Sheldon [6] described the only two known exceptions to that part of the axiom previously cited which refers to homologous twins, since they are concerned with the occurrence of pyloric stenosis in but 1 member of a set of homologous twins, the other being normal. Sheldon reported 12 cases in which pyloric stenosis occurred in only 1 member of a set of heterologous (dizygotic, or binovular) twins, an occurrence in accord with the part of the axiom regarding heterologous twins.

This report is being published because thorough study of the literature failed to reveal any other instance of the occurrence of pyloric stenosis in both members of a set of heterologous twins. The fact that one exception occurs does not necessarily carry much weight, but in view of the rarity of maladies such as pyloric stenosis in multiple sets only constant vigilance and reporting of abnormal occurrences will finally result in a crystallization of the problem related to the disease.

REPORT OF CASES

CASE 1 (dizygotic twins Richard and Robert B.).—The patients were born at the Wilkes-Barre General Hospital on July 21, 1940. The obstetrician described the placenta as a single body with a line of fusion between the two halves; there were two sacs and two cords, one being attached to each half of the placenta, which is indicative of dizygotic twinning. Both infants were discharged apparently well and were taken care of by the family physician, who had difficulty with their feeding almost immediately. He stated that both children had had attacks of projectile vomiting after practically every feeding, which were not relieved by antispasmodics.

Richard's condition was much the more severe of the two; he continually vomited all feedings and was admitted to the hospital after convulsions had occurred every few minutes for twenty-four hours. He was in the active stage of generalized convulsions, and examination showed that he was very dehydrated and undernourished. The skin was of poor turgor and cyanotic; the head was normal in contour, and the fontanel was not bulging. The eyes, ears and throat were normal. The neck was stiff, in opisthotonos; the reflexes were exaggerated generally; the lungs and heart were normal. A diagnosis of infantile tetany was made, and pyloric stenosis was suspected in view of the history of repeated vomiting and some constipation. The convulsions ceased after the intravenous administration of 75 cc. of Ringer's solution to which 15 cc. of calcium gluconate had been added. After cessation of the convulsions the abdomen was more easily palpated; a pyloric tumor was outlined, and peristaltic waves noted. Administration of atropine sulfate was tried for a few days, without success, and a roentgenogram gave evidence of retention of the barium sulfate mixture. Subcutaneous administration of fluids was continued until operation.

Robert B. was admitted two days later with a similar history of projectile vomiting, but his condition was not as serious as that of his brother, and parenteral administration of fluids was not required. Examination showed that the head, neck, throat, lungs, ears and reflexes were normal, but a pyloric tumor was palpated in the right upper quadrant of the abdomen, and peristaltic waves were seen without difficulty.

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10. Lasch, W.: München. med. Wchnschr. **72**:1155, 1925.

The 2 infants were operated on successively. The classic Rammstedt operation was performed by Dr. S. Freeman, and tumors of almost identical size were found. The postoperative course was uneventful except that Robert did not gain well at first, but after he was given the impetus of a blood transfusion his convalescence was short and uncomplicated.

CASE 2 (brothers A. R. and G. W. S.).—A. R. S., aged 3 weeks, was admitted to the hospital on April 20, 1934 with a history of vomiting of one week's duration. There had been difficulty in feeding the child since birth, and he had had attacks of constipation. The two days before admission he was feverish and vomited all of his food. He was very dehydrated and emaciated and looked acutely ill; his skin was hot and dry and of poor turgor. The results of a general examination were negative except for the presence of a palpable tumor in the right upper quadrant of the abdomen. A roentgenogram showed pyloric stenosis, and operation revealed a pyloric tumor. The convalescence was uneventful.

G. W. S., aged 2 months, was admitted to the hospital on Aug. 7, 1936 with a history of vomiting for two weeks. The child weighed 7½ pounds (3,402 Gm.) at birth and had gained well; he weighed 12½ pounds (5,670 Gm.) at the age of 2 months, when projectile vomiting occurred after almost every feeding for two weeks. Constipation was a frequent complaint. The results of examination were essentially negative except for the presence of a small tumor mass in the right upper quadrant of the abdomen. A roentgenogram showed pyloric stenosis, and the diagnosis was substantiated at operation. His convalescence was interrupted by the bursting of the abdominal wound, which was repaired, and he was discharged on September 17.

CONCLUSIONS

Another case of the occurrence of pyloric stenosis in twins is added to the rather meager list in the literature as a further step toward the understanding of the disease. The occurrence of the tumor in both members of a set of nonidentical twins constitutes an exception to the rule. It is only with constant attention and reporting of such instances that it will ever be possible to come to any definite decision in the matter of the possible hereditary pathogenesis of tumors, and especially of pyloric stenosis. It is strongly urged that in reporting the cases of twins a definite description of the placenta be given as one proof of the type of twinning present.

SUMMARY

A case in which congenital pyloric stenosis occurred in both members of a set of nonidentical twins and recovery followed operation is presented, and the cases of 2 brothers with the disease who were operated on two years apart, with recovery, are reported. A table listing the cases of pyloric stenosis in twins, identical and nonidentical, which have been reported in the literature is given.

It is believed that the cases presented afford additional evidence in support of the theory of the hereditary pathogenesis of some tumors, especially of pyloric stenosis.

CONGENITAL MELANOMA

REPORT OF A CASE IN WHICH ANTENATAL METASTASIS OCCURRED

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The presence of pigmented nevi on the skin of infants at birth, while unusual, is well known. Such lesions vary considerably in size and may cover almost the whole body surface. They are generally regarded as being entirely benign or of very low malignancy at this age period.[1] In an exhaustive review of the literature, Wells [2] was able to find only 5 instances of malignant melanoma in early infancy. The only case in which he thought it even probable that a pigmented mole had been malignant before birth was that reported by Coe [3] in 1925, in which small moles present at birth caused death at 4 months of age. In another instance, an infant at birth "had innumerable gray-brown spots up to bean size over the entire body." The infant, who died at 7 months of age of tuberculosis, had nodules of melanosarcoma in the brain. Details are lacking as to whether this was a case in which generalized melanosarcomatosis was present at birth. In the other cases collected by Wells the tumors were not associated with cutaneous lesions.

A unique case of transmission of melanoma from the placenta to the fetus was reported by Weber, Schwarz and Hellenschmied.[4] Three months before her death from melanotic carcinoma with visceral and

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From the Departments of Pediatrics and Pathology of the Gallinger Municipal Hospital and of Georgetown University School of Medicine.

1. Pack, G. T., and Anglem, T. J.: Tumors of the Soft Somatic Tissue in Infancy and Childhood, J. Pediat. **15**:392 (Sept.) 1939. Grulee, C. G., and Bonar, B. E.: The Newborn: Diseases and Abnormalities, in Haynes, R. S.: Clinical Pediatrics, New York, D. Appleton and Company, 1928, vol. 3. von Reuss, A. R.: The Diseases of the Newborn, New York, William Wood & Company, 1921.

2. Wells, H. G.: Occurrence and Significance of Congenital Malignant Neoplasms, Arch. Path. **30**:535 (Aug.) 1940.

3. Coe, H. E.: Malignant Pigmented Mole in an Infant, Northwest Med. **24**:181 (Dec.) 1925.

4. Weber, F. P.; Schwarz, E., and Hellenschmied, R.: Spontaneous Inoculation of Melanotic Sarcoma from Mother to Foetus, Brit. M. J. **1**:537 (March 22) 1930.

subcutaneous metastases the mother was delivered of an apparently healthy child. The placenta was heavily infiltrated with a melanotic growth. The infant developed normally at first, but at 8 months of age he was found to have a large, nodular liver. He failed rapidly and died at 10 months of age. At necropsy several large, apparently slowly growing melanotic tumors were found in the liver, and many smaller metastatic foci were present elsewhere in the body. Since there was no "primary" focus in the infant, it was thought that he had been inoculated from the placenta via the umbilical vein.

The absence of reports of cases in which malignancy of pigmented moles was evidenced before birth and the extreme rarity of cases in which such malignancy was established even shortly after birth make it desirable to record the observations in the case of a newborn infant recently studied by us in which there was undoubted evidence of antenatal metastasis of a malignant tumor, probably a melanoma.

REPORT OF CASE

On Nov. 21, 1939, infant McG., a white boy aged 3 hours, was admitted to the pediatric service of the Gallinger Municipal Hospital. The infant's mother was aged 25. She had vomited frequently during the first six months of pregnancy and had complained of dizziness, headache and visual disturbances. Swelling of the right foot and leg had been present during the same period, but she had sought no medical advice. She had 1 other child, aged 3 years, who was well. There was no history of cancer in the family.

The patient was born spontaneously after a normal eight hour labor. The placenta, which was passed normally, was normal on gross and microscopic examination at the hospital. The mother was admitted to the gynecology service the day after delivery. Her postpartum course was normal, and she was discharged in good condition on the eleventh day post partum. On Aug. 11, 1941 she was delivered of her third child, a normal boy. She was well and showed no evidence of melanoma at that time.

Physical Examination.—The infant was brought to the hospital immediately after birth. His body was covered with numerous darkly pigmented, moderately indurated, elevated lesions. These varied from pinpoint size to 3 cm. or more in diameter (fig. 1). The larger lesions supported a growth of coarse hair. There was a large, confluent, dark brown lesion covering the whole of the diaper region and extending down the right leg to below the knee.

The external genitalia were replaced by large fungating growths, through one of which the infant was seen to void. There were other similar growths from the perineum and around the anus (fig. 2). The abdomen was distended, and there were palpable masses extending approximately 5 cm. below the costal margin in both upper quadrants. These were thought to represent the greatly enlarged liver and spleen. Ophthalmoscopic examination of the ocular fundi revealed no abnormality of the disks, retinas, choroids or vessels. Roentgenographic examination of the skeleton showed no evidence of bony abnormality.

Biopsy.—On December 1 a specimen for biopsy was taken from a cutaneous lesion. Microscopic examination of a section of this tissue showed undifferen-

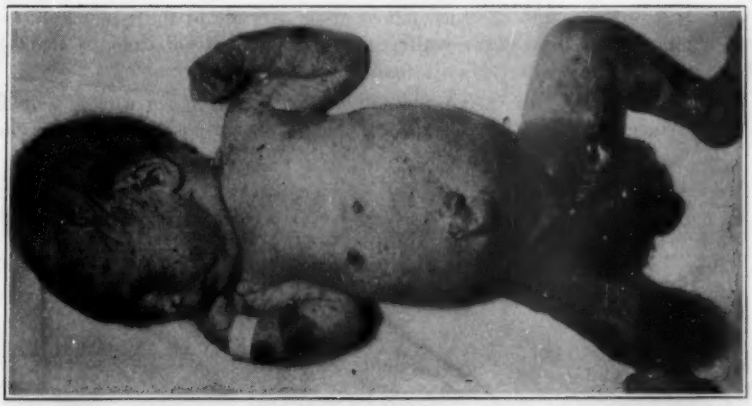

Fig. 1.—Photograph of the patient, showing the size and distribution of the cutaneous lesions.

Fig. 2.—The perineal region and abdomen, showing the perineal tumors. The palpable abdominal organs are outlined in pencil.

tiated tumor cells arising from the basal layer of the epithelium and projecting in short masses down into the subcutanous tissue. Some of the tumor cells contained pigment, and there were scattered bits of pigment intermingled with the cells in many areas. A few mitotic figures were seen.

Course.—The infant was given supportive care, but he failed rapidly and died on the seventeenth day of life. The pigmentation of the cutaneous lesions dark-

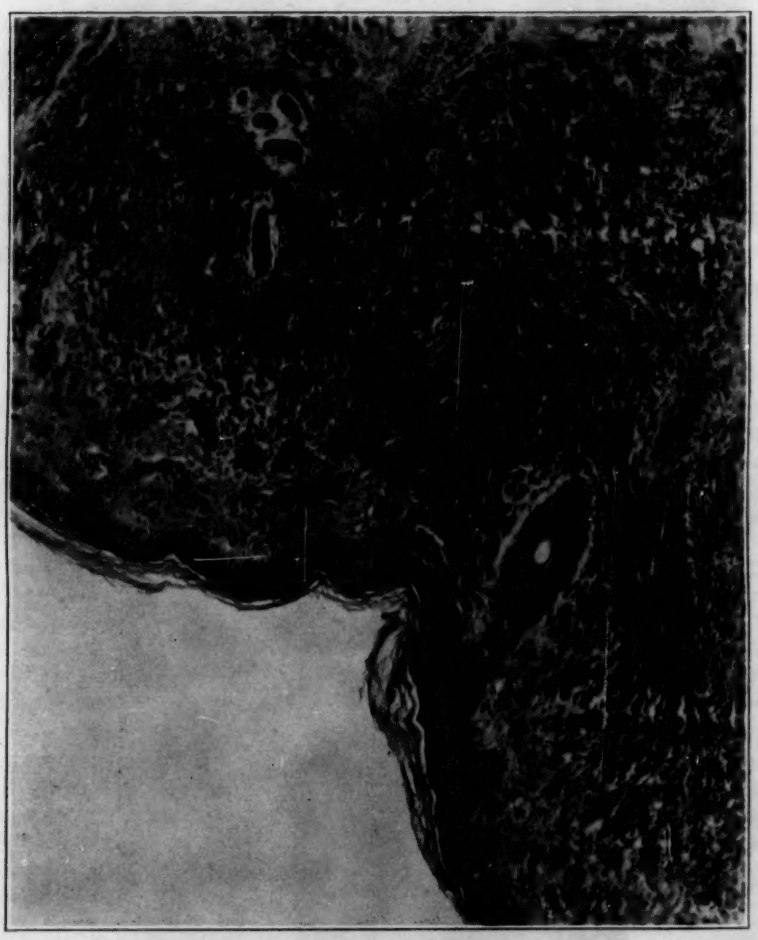

Fig. 3.—Section of skin; × 132.

ened perceptibly during the patient's life, but there was no definite evidence of increase in size of any of the lesions.

Autopsy.—Gross Examination: The body was that of a malformed infant 48 cm. in length and weighing 1,900 Gm. The skin of the right thigh and the upper two thirds of the lower part of the right leg was deeply colored with a rather uniform brownish black pigment. The skin was not thickened, but there were numerous elevated, circumscribed nevi 4 to 5 mm. in diameter, which were

especially numerous over the inner aspect of the thigh. There was a similar pigmentation of both buttocks, the sacrum, the lumbar region, the upper portion of the left thigh and the lower part of the abdomen. All of these areas were continuous with themselves and with the pigmented area of the right thigh. On the lower part of the left thigh and the lower portion of the left leg there were ten

Fig. 4.—Section of tumor tissue replacing the external genitalia; × 240.

discrete, nonelevated or very slightly elevated patchy areas of brown pigmentation 1 cm. in diameter; normal skin intervened between these lesions. There were fairly numerous discrete, nonelevated areas of brown pigmentation measuring from 1 to 10 mm. scattered over the skin of the entire trunk and head, including the face and the scalp.

Penis and Scrotum: The penis was represented by a polypoid mass without definite foreskin or glans but with a urethral meatus placed superiorly. The end

of the organ measured 2.5 cm. in diameter, but it was constricted at the base, where it was about 8 mm. in diameter. The scrotum was represented by a solid ulcerated mass 3 cm. in diameter. The inferior aspect of the mass was fungating and ulcerated. Section through both the penis and the scrotum showed them to be made up of a translucent, uniform, homogeneous, gray tissue resembling fish

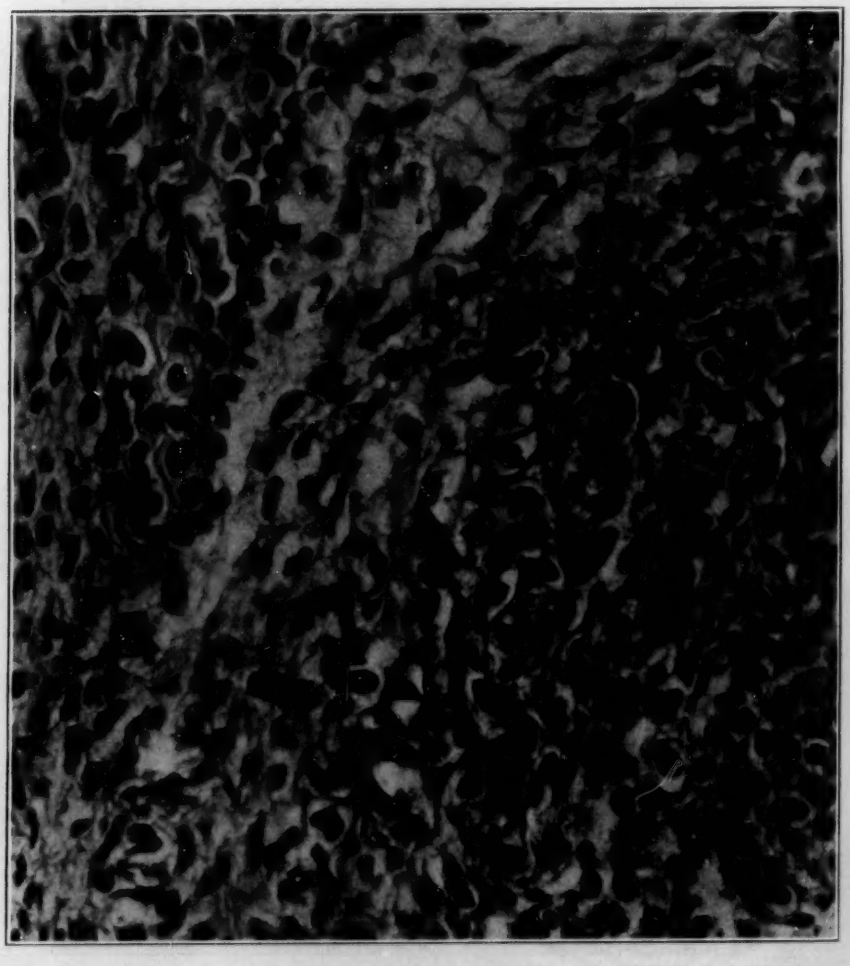

Fig. 5.—Section of tumor tissue replacing the external genitalia; × 705.

flesh. There was no erectile tissue in the penis. The urethra ran along the dorsum of the organ. There were no gonads in the mass of tissue representing the scrotum. In one section of the scrotal mass there was an infarction, a superficial, wedge-shaped, softened, opaque yellow area. About the anus there were large fungating, cauliflower-like masses measuring 2 by 1 cm. On section they were seen to be made up of the same type of homogeneous, gray "fish flesh" tissue.

Liver: The liver was greatly enlarged. The surface was smooth and the capsule thin. Shining through the capsule were numerous, circular, yellow areas 3 to 8 mm. in diameter and also several thin-walled cysts 1 to 2 cm. in diameter, which caused bulging of the surface. The cut surface was studded with numerous nonelevated, gray nodules which ranged from 1 to 8 mm. in diameter. In addi-

Fig. 6.—Section of the liver; × about 132.

tion, several smooth, thick-walled cysts 1 to 2 cm. in diameter and filled with clear straw-colored fluid were present. The liver parenchyma itself, where it was not involved by the lesions, was pale brown and not mottled. The liver cut with greatly increased resistance.

Gonads: At the brim of the pelvis, on either side, were small, flattened, oval glandular structures measuring about 1 by 0.5 cm. which represented the gonads. Both structures were definitely adherent to the pelvis. What appeared to be a

ductlike formation arose from each gland and ran retroperitoneally back to the bladder, where it disappeared.

Brain: The brain was anatomically well formed and well developed. The meninges were normal. A section through the pons showed a pigmented area 8 mm. in diameter which had a circular, sun-rayed arrangement. A few similar small, pigmented areas were scattered throughout the cerebral cortex. The ventricles were not dilated. There did not appear to be any other metastatic nodules in the brain.

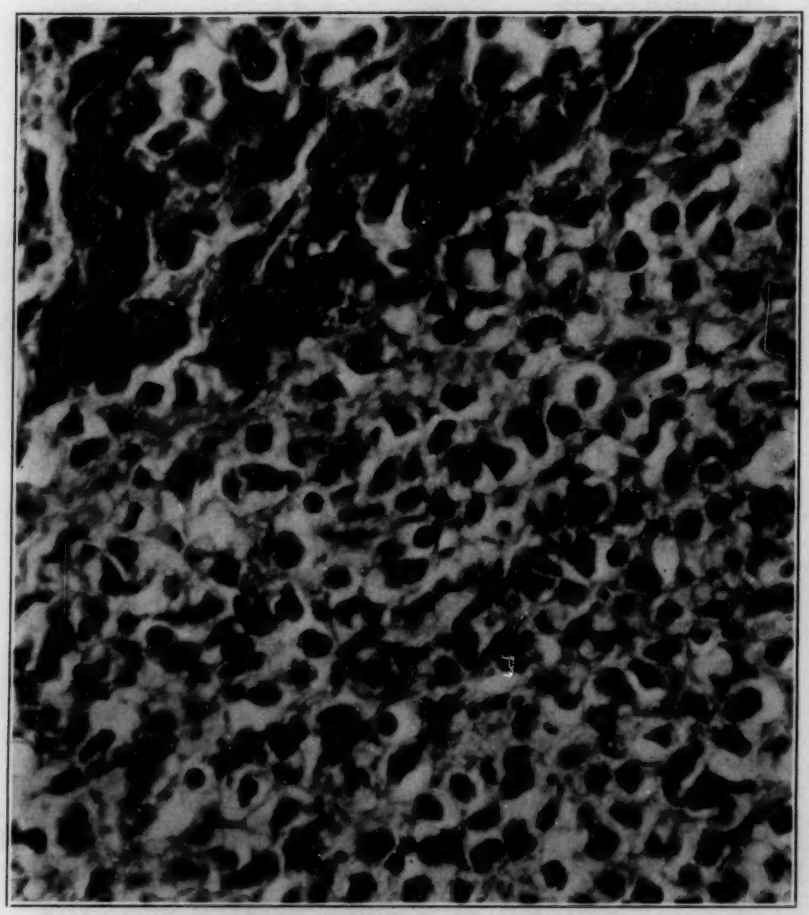

Fig. 7.—Section of the liver; × 705.

Other Organs: The body cavities and all the other viscera were normal in appearance. There were no other tumor nodules.

Microscopic Examination: Skin: The sections of the skin of the thigh (fig. 3) showed a thin epidermis covering the surface. Beneath this was a wide zone of dense accumulations of nevus cells interspersed with numerous clusters of cells deeply pigmented with melanin. The entire dermis showed extreme cellularity,

which in the outer areas resulted from the greatly increased numbers of spindle and round cells.

Perianal and Genital Tumor Masses: Sections of the perianal tumor masses (figs. 4 and 5) and of those representing the penis and scrotum showed essentially the same picture. There was a thin covering of epidermis, which was absent in

Fig. 8.—Section of the pons Varolii; × about 132.

some areas as a result of ulceration. The basal layer of the epidermis was free from pigment. The specific tissue comprising these masses showed uniform cytologic and architectural features. The tissue was composed of closely packed cells having oval, spindle-shaped or round nuclei and a small amount of cytoplasm. Between the cells there was a variable number of delicate reticular intercellular fibers. In general, the tissue was very cellular, and the intercellular substance was relatively small in amount. The tumor cells appeared very similar to fibro-

blasts, and the tissue itself resembled a very cellular neurofibroma. Some of the sections showed sharply differentiated whorled areas, and a distinct tendency to fasciculation was evident throughout many parts of the tumors. Pigmentation of the tumors, when present, was confined to a narrow zone just beneath the epidermis, where a few scattered cells containing melanin were seen. The deeper portions were entirely devoid of pigment.

Liver: The liver (figs. 6 and 7) showed numerous macroscopic and microscopic areas of replacement of the parenchyma by tumor. The tumor cells were polyhedral or round; a few were spindle shaped. Anaplasia was marked. The cytoplasm was indistinct and blended imperceptibly with the intercellular substance. The tissue was very cellular, and the intercellular substance consisted of a delicate reticulum. Some of the cells seemed to fuse together and form a syncytium. The architecture resembled that of a reticulum cell lymphosarcoma. No pigment of any kind was present within or about any of the tumor cells in the liver.

Microscopic areas of tumor infiltration were numerous. In the smallest foci the tumor cells were seen to be growing along the sinusoids without destroying the liver cells. In fact, the majority of these tumor masses were actively invading the parenchyma after the manner of true metastases. The cysts in the liver, described previously, were seen to possess narrow walls made up entirely of tumor tissue and devoid of any epithelial lining. The characteristics of this tissue were identical with those of the solid tumor tissue in the liver. The liver parenchyma itself in the uninvolved areas was not remarkable.

Pons Varolii: The section of the pons Varolii (fig. 8) was taken through the pigmented area noted grossly. It showed numerous separated small clusters of cells, as well as isolated single cells, which were deeply pigmented with melanin and scattered about in relation to the blood vessels or infiltrating the tissue. No conglomerate tumor nodules were present.

Other Organs: Sections of the other organs showed no tumor tissue. There were a few foci of bronchopneumonia but no other abnormalities. The gonads were not examined histologically.

COMMENT

It is at once apparent that in the differential diagnosis in this unusual case of congenital neoplasia one must consider (1) congenital nevus complicated by malignant melanoma and (2) neurofibromatosis (Recklinghausen's disease) complicated by neurogenic sarcoma and congenital nevi. Regardless of the diagnosis reached, one must recognize that there were definite antepartum metastases.

The association of melanoma with various phases of cutaneous neurofibromatosis was first observed in 1882, by von Recklinghausen.[5] Soldan [6] confirmed von Recklinghausen's view that pigmented nevi are related to neurofibromas. According to one modern school of thought [7]

5. von Recklinghausen, F.: Multiplen Fibrome der Haut, Berlin, August Hirschwald, 1882.

6. Soldan: Ueber die Beziehungen der Pigmentmäler zur Neurofibromatose, Arch. f. klin. Chir. **59**:261, 1899; cited by Ewing,[7] p. 949.

7. Ewing, J.: Neoplastic Diseases, ed. 4, Philadelphia, W. B. Saunders Company, 1940.

both tumors arise from neuroepithelium, the neurofibromas originating from the Schwann cells and the nevi from the neuroepithelial end organs, the Meissner corpuscles.

In the remarkable case of a 9 month old infant described by Berblinger [8] multiple melanomas of the skin and neurofibromatosis were associated with a melanotic tumor of the gyrus hippocampi, multiple pigmented spots in various portions of the brain, glioma of the pons, diffuse perithelial sarcoma of the cerebrospinal pia, with secondary deposits of pigment, and a true accessory adrenal: This case was similar to cases described by von Recklinghausen.[5]

Neurofibromatosis consists of a congenital, and often hereditary, disturbance in the growth and differentiation of the ectoderm. Its main clinical manifestations consist of a series of remarkable tumors of the peripheral sensory, motor and sympathetic nerves associated with a great variety of anatomic and functional abnormalities in the central nervous system, the vascular system, the bones and the endocrine glands. In the characteristic case there are multiple tumors of the skin and often tumors of the deeper nerve trunks associated with a great variety of abnormalities. In the brain one may find gliosis, gliomas and tuberous sclerosis, and spina bifida and meningocele may be present. Nevi of several varieties are encountered, namely, pigmented nevi, melanomas, bathing trunk nevi and neuropathic papillomas. Elephantiasis, cysts and tumors of bones and endocrine disturbances have also been reported.[7] The disease is often complicated by lipomas, neurolipomas and neurosarcomas.

Ewing [7] stated that the structure of both primary and metastatic melanomas shows wide variations. The tumor may appear as an alveolar or a diffuse carcinoma, as a large spindle cell sarcoma, often as a perithelioma and even as a lymphosarcoma. There is no constant relation between the degrees of pigmentation of primary and of metastatic tumors. A heavily pigmented tumor may give rise to pigment-free metastases.

In the present case microscopic study of the tumors of the penis, the scrotum and the perianal region suggests the diagnosis of neurosarcoma. Against this diagnosis are the absence of tumors of the peripheral nerves and the presence of only a single pigmented node in the brain. The cutaneous lesions appear to be pigmented nevi, and the characteristics of the metastatic tumors are compatible with such a diagnosis.

Perhaps an absolute distinction between melanoma and neurofibroma cannot be made, since the microscopic pictures of nonpigmented anaplastic metastatic melanomas and of neurosarcomas may be very similar.

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8. Berblinger, W.: Ein Beitrag zur epithelialen Genese des Melanins, Virchows Arch. f. path, Anat. **219**:328, 1915.

The closely related histogenesis of the two conditions makes an absolute distinction between them not so important as would appear at first sight.

We favor the diagnosis of congenital melanotic nevi complicated by the antenatal development of metastatic nonpigmented melanomas in the skin, the liver and the brain.

SUMMARY

A case of congenital malignant tumor in which antenatal metastasis occurred is reported. The clinical and anatomic observations indicate that the tumor probably was a melanoma.

UNCOMPLICATED INTERATRIAL SEPTAL DEFECT (PATENT FORAMEN PRIMUM)

REPORT OF A CASE IN WHICH CONGESTIVE HEART FAILURE AND DEATH OCCURRED AT ONE MONTH OF AGE

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AND

H. M. PUTNAM, M.D.

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Instances of uncomplicated congenital defects in the interatrial septum are not common. Tinney,[1] in the most recent publication dealing with this subject, brings the total number of reported cases up to 86. Of this number, the first series to be analyzed consisted of 62 cases considered by Roesler.[2]

In the following case there was a patent foramen primum. This simple defect in the lower portion of the interatrial septum was alone sufficient to produce clinically recognizable and pathologically demonstrable congestive heart failure, and death occurred at 1 month of age. Such a chain of events is unique in the light of previously reported cases.

REPORT OF CASE

History.—The patient, a 1 month old white boy, was admitted to the Children's Hospital (service of Dr. J. P. Scott) July 29, 1940 with the chief complaint of difficulty in breathing. The mother had noticed that about one and a half weeks prior to admission labored respirations with indrawing of the abdomen just below the costal margins had developed. The infant was said to have turned blue about the lips during severe crying spells but to have been free from cyanosis at other times. There was no history of cough, aspiration of a foreign body or infection of the respiratory tract. The birth and family histories were noncontributory.

Physical Examination.—Examination revealed a well formed, well nourished infant of normal length and with normal head and chest measurements. He was having moderate respiratory distress, which was demonstrated by retraction of the jugular notch and xiphoid process and moderate indrawing of the costal interspaces. Cyanosis of the lips and nail beds was evident. Occasional moist crepitant rales were heard throughout the left pulmonary field. Examination of the heart revealed moderate enlargement to the left and craniad. There was

From the Department of Pediatrics, University of Pennsylvania School of Medicine, and the Children's Hospital.

1. Tinney, W. S., Jr.: Interauricular Septal Defect, Arch. Int. Med. **66**:807 (Oct.) 1940.

2. Roesler, H.: Interatrial Septal Defect, Arch. Int. Med. **54**:339 (Sept.) 1934.

marked tachycardia, with a rate of 200 beats per minute, accompanied by gallop rhythm. No murmurs were detected. The sharp edge of the liver was felt 2 cm. below the right costal margin.

Laboratory Data.—The erythrocytes numbered 5,310,000 per cubic millimeter, and the hemoglobin content (Sahli) was 13 Gm. The leukocytes numbered 11,900 per cubic millimeter, with 52 per cent neutrophils, 46 per cent lymphocytes and 2 per cent monocytes. The Wassermann reaction of the blood was negative and the blood culture sterile. A roentgenogram of the chest (fig. 1) revealed marked cardiac enlargement, particularly noticeable along the median and the left lower border.

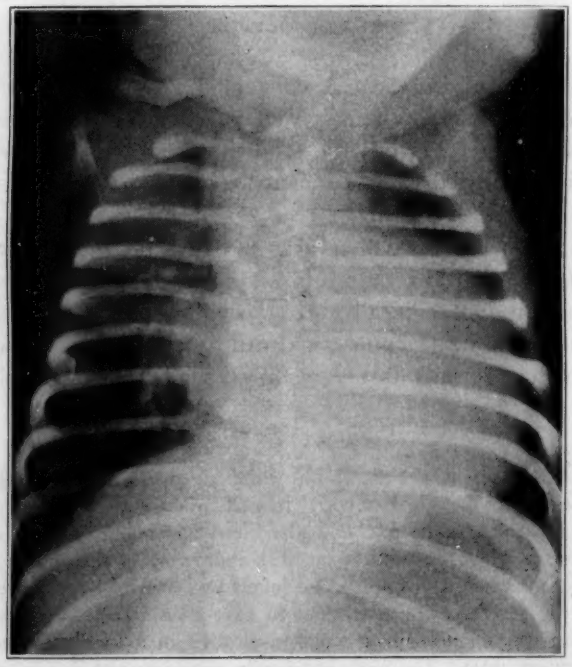

Fig. 1.—Roentgenogram of the chest, showing marked cardiac enlargement.

Course.—The infant took his feedings well and voided normal amounts of urine. On the evening after his admission to the hospital, dyspnea became marked and edema of the hands and face appeared. The edge of the liver was felt 4 cm. below the right costal margin. There was no response to administration of oxygen, subcutaneous injection of digitalis and other measures, and he died rather suddenly.

Autopsy.—Autopsy was performed by Dr. Irving Wolman. Only the significant observations are reported.

Heart: The pericardium contained about 10 cc. of clear straw-colored fluid. The transverse cardiac diameter was 7 cm. (normal average for this age, 5.2 cm.) as compared with 10 cm. for the inner diameter of the thorax at the cardiac level. The aorta and the pulmonary arteries were in normal relative position.

On inspection of the heart in situ (fig. 2), the left ventricle was not seen and the ventricular septal groove was not apparent. The right atrium was dilated and hypertrophied. The foramen ovale appeared to be functionally closed, although a probe could be passed obliquely through it into the opposite atrium. In the

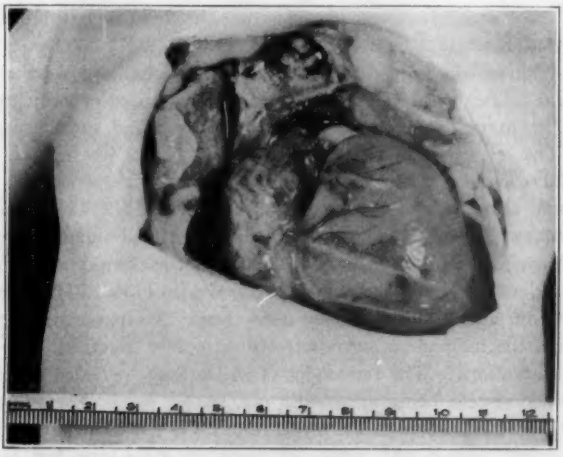

Fig. 2.—Appearance of the heart in situ.

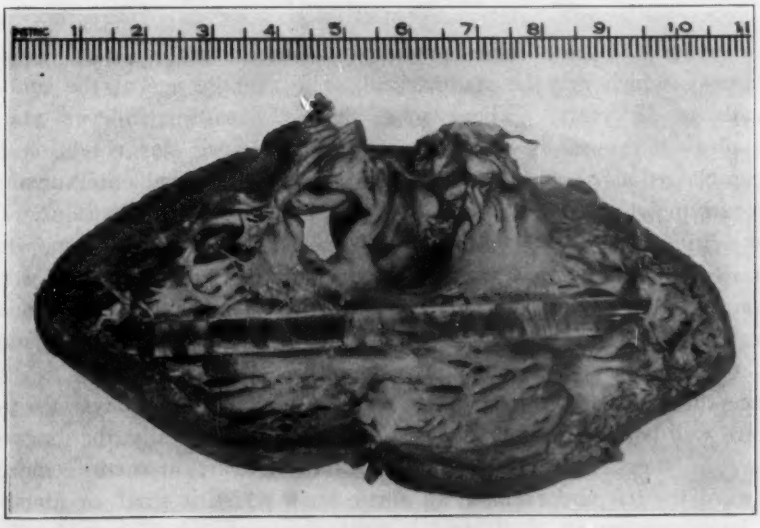

Fig. 3.—Appearance of the circular defect in the interatrial septum.

interatrial septum there was a circular defect measuring 1.6 cm. in diameter (fig. 3) situated just above the septal ridge. The left atrium was considerably smaller than the right, and the right ventricle was dilated, its wall measuring 0.5 cm. in thickness (normal, 0.45 cm.). The tricuspid valve was normally formed and measured 6.5 cm. in circumference. The circumference of the pulmonary

valve was 3 cm. (normal, 2.6 cm.). The left ventricle, in contrast to the right, was small, and its wall measured 0.4 cm. in thickness (normal, 0.55 cm.). The mitral valve appeared normal. The circumference of the aorta was 2 cm. (normal, 2.37 cm.), and its cusps were apparently normally formed. The coronary arteries originated in their usual positions. There were no defects in the interventricular septum, and the ductus arteriosus was closed. The heart weighed 70 Gm. (average weight for this age,[3] 17.2 Gm.).

Thorax: There was no pleural effusion. The right lung weighed 80 Gm. and the left 50 Gm. The dorsal half of the right lung appeared cyanotic and edematous. On section, the parenchyma was deep red and moist, and some areas appeared to be airless. The left lung showed similar changes but of less degree.

Abdominal Cavity: The peritoneum was smooth and free of adhesions, and the abdominal cavity contained about 15 cc. of fluid. The connective tissue of the mesentery at the root of the liver and the round ligament about the gallbladder were yellow and edematous. The liver was large; its parenchyma was moist and dark red, and the veins were distended with blood. The spleen was large, weighing 30 Gm. and measuring 6 by 5 by 2 cm. Its parenchyma was dark red and moist, and the malpighian corpuscles could not be identified.

Other Observations: The remainder of the autopsy revealed nothing of significance, the other viscera being apparently normal.

On microscopic examination the myocardium was apparently normal. The lungs showed engorged vessels and scattered areas of atelectasis but no evidence of pneumonia or bronchial infection. Cultures of material from the lungs were sterile.

COMMENT

Analysis of the 86 cases previously reported reveals certain general features, which may be summarized. The average age at the time of death is 37 years. There is a slightly greater incidence among females. Cyanosis is a late manifestation; hence this condition has been classed as *cyanose tardive*.[4] The occurrence of thrills and murmurs is extremely variable and, as a rule, is of little diagnostic value. The majority of the patients have a superimposed rheumatic infection, which most commonly involves the mitral valve, and this has led to the description of Lutembacher's[5] syndrome, consisting of interatrial septal defect, mitral stenosis and dilatation of the pulmonary artery. Roesler[2] stated that the coexistence of acquired valvular lesions did not seem to influence the prognosis and that anesthesia, pregnancy and physical effort were well borne in a number of cases. Roentgenologically, the diagnosis may be suggested by the observation of a heart markedly enlarged toward the left and craniad, an aortic knob which is small or invisible, a large pulmonary conus and a pulmonary artery which with all its

3. Martin, R., and Bach, F.: Maass—Verhältnisse an den Eingeweiden, Tabulae biol. **3**:704, 1926.

4. Abbott, M. E.: Atlas of Congenital Cardiac Disease, New York, American Heart Association, 1936, p. 12.

5. Lutembacher, R.: De la sténose mitrale avec communication interauriculaire, Arch. d. mal. du cœur **9**:237, 1916.

branches is enlarged. Fluoroscopically, the pulmonary artery and its vessels show increased pulsations. The gross pathologic features are clearly demonstrated in figures 2 and 3.

The question has repeatedly been raised whether the accompanying valvular lesions are congenital or whether they are always acquired as a result of rheumatic infection. Taussig and associates [6] have expressed the opinion that the acquired lesions are the most common, although they have pointed out that patients with such lesions frequently have precordial bulging, which is strong evidence of cardiac enlargement in very early life and causes one to conclude that the congenital defect alone initiated hypertrophy or that rheumatic carditis occurred very early. The case presented here is evidence that marked enlargement may occur in a short time and as a result of the defect alone. Embryologically, the primitive two-chambered heart develops into a four-chambered organ by the formation of septums. From the cephalic wall of the atrium the septum primum is formed and grows downward to join the intermediate septum. Failure to join results in the defect exemplified in the case reported here. The normally patent foramen ovale forms cephalad on the septum primum, so that in fetal life there is always a communication between the two atria.

It is evident that enlargement of the heart in this case represents a change taking place entirely within the one month of postnatal existence, for during fetal life the presence of this defect throws no added load on the heart. It is difficult to explain why in this case congestive heart failure should develop and the infant die in one month's time, while in the majority of cases the course is much slower. The presence of severe anemia or of infection is known to accelerate the development of congestive heart failure in susceptible subjects, particularly in infants,[7] but it seems clear that neither of these factors was operating in this instance.

SUMMARY

A case of patency of the primitive foramen is presented in which death occurred from clinically recognizable and pathologically demonstrable congestive heart failure at the age of 1 month.

The general features of interatrial septal defects are briefly summarized.

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6. Taussig, H. B.; Harvey, A. M., and Follis, R. H., Jr.: The Clinical and Pathological Findings in Interauricular Septal Defects, Bull. Johns Hopkins Hosp. **63**:61, 1938.

7. Ash, R.; Wolman, I. J., and Bromer, R. S.: Diagnosis of Congenital Cardiac Defects in Infancy, Am. J. Dis. Child. **58**:8-28 (July) 1939.

Progress in Pediatrics

THE SCHOOL HEALTH SERVICE AND THE PRIVATE PHYSICIAN

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The objectives of the school health service have undergone radical changes since the introduction of medical inspection into the Boston schools in 1894. While the only purpose of early medical inspection was the control of communicable diseases, school health programs today are designed to serve in the much broader field of health guidance and education.

In New York city the Department of Health during the past several years has introduced changes in school health procedures [1] and has conducted an intensive staff-training program for the purpose of emphasizing the health guidance aspect of the service. The school medical examination is now becoming an educational tool. The school physician is concerned with the child as an individual. He seeks to obtain such information, through the history and the examination of the child, as will help him to guide the parents in planning for the care of the health problems which are uncovered.

In the training program conducted for the school physician two subjects received special emphasis: health education and the use of community resources. That sound health education is a pressing need is evident when one recalls that faith healers and manufacturers of nostrums receive annually hundreds of millions of dollars from the American public. To this must be added the evidence for the need of education about health awareness and health habits which was so well demonstrated in a recent study conducted by the New York State Education Department.[2]

From the Department of Health, New York City.

Read at the joint meeting of the Section on Preventive and Industrial Medicine and Public Health and the Section on Pediatrics at the Ninety-Second Annual Session of the American Medical Association, Cleveland, June 6, 1941.

1. Nyswander, D. B.: Astoria School Health Study: Report of a Four Year Study Undertaken in Order to Develop a Better Health Program for the Children of New York City, to be published.

2. O'Neil, F. C., and McCormick, M. G.: Everyday Behavior of Elementary School Children, Albany, University of the State of New York, 1934.

The intelligent use of community resources by the public is, of course, one of the aims of health education. It is now generally accepted that the health services rendered within the school must be integrated with the existing community resources if they are to have value for the child and his parents. The school health examination is not an end in itself. It should help to initiate desirable attitudes toward health, and it should serve as a mainspring to action resulting in the intelligent use of community resources.

Occupying an important place among the community resources are the family physician and the family pediatrician. A responsible school health program must teach the value and encourage the use of the medical and health services which such physicians are able to render to the community. The health examination is a relatively new concept. Although its value during infancy is generally accepted by the public, its value for the preschool and school age child is too little appreciated. Gudakunst [3] and others have pointed out that perhaps the most important function of the school health service is to educate parents and children to assume the responsibility for seeking the services of the medical profession both in the treatment of disease and in the maintenance of health.

A program coordinating the health services of the school and the private physician places certain responsibilities on both. For the school there is the responsibility for health education. This should include the teaching of health facts, guidance in health habits and the development of individual responsibility for the maintenance of health. Second, when the health examination is performed by the school physician there is the responsibility to define the purpose, the scope and the limitations of the examination. The parent should see the examination in true perspective, as a case-finding and referral procedure, and gain from it sound information for securing health and medical guidance. Third, there should be provision for the follow-up of children in whom defects have been discovered. Such follow-up is essential for the success of the school health program. Fourth, the school should provide for elasticity in the curriculum and in the program of activities, so that the special needs of individual children may be met. There are, of course, other responsibilities which the school has for maintaining the health of children. These four are enumerated because they bear directly on the relation between the school and the private physician.

For the private physician there is the responsibility for providing a health examination which meets the needs of the developing child and maintains the parental interest and initiative in seeking continued health

3. Gudakunst, D. W.: A School Health Program, J. A. M. A. **111**:881 (Aug. 27) 1938.

guidance. Second, the private physician has the important function of informing the schools of the health status of the child, so that, when necessary, changes in curriculum and in activities can be made to meet his needs.

The degree of cooperation which exists between the school health service and the medical practitioner depends, in most instances, on the mutual understanding and respect that each has for the services the other can render. In some communities the extent of the private physician's participation may be nil, because he has neither been accorded a place nor sought a place in the school health program. In other communities his participation may be negligible and confined to the receipt of an occasional note from the school informing him that his patient has "tonsils," a fact of which he is undoubtedly fully aware. In still other communities the private physician may play an active role in all phases of school health work.

The school health program in New York city calls for a health examination of all new entrants to the public and parochial schools, the examination of children in all other grades who present health problems and the follow-up of children who are in need of medical care. Special phases of the health work include programs for immunization against diphtheria, biannual measurements of height and weight, periodic audiometer testing, programs for dental hygiene and a cardiac consultation service for the medical practitioner and the school authorities.

The private physician has an opportunity to participate in all phases of the program. In the first place, he is called on by many parents to carry out the necessary health examination, vaccination and immunization against diphtheria for children who are entering school for the first time. During the past four and one-half years the proportion of such health examinations made by private physicians has increased from 14 (18,022) to 36 (33,954) per cent. This represents a notable increase which may be taken as an index of the effectiveness of the parent education program carried on by the Department of Health and by the schools. There is, of course, a high correlation between the economic status of the district and the percentage of health examinations conducted by private physicians. In one of the areas of the city during this past school term 7 of every 10 health examinations were made by private physicians.

A second way in which the private physician participates in the school program relates to his treatment of children who are referred to him because of some specific health problem. Such problems are usually discovered through the observation of the children by teachers, school nurses and school physicians. Special programs have been developed for facilitating the detection of visual, auditory and nutritional defects. It is here that the school health service is discharging its important responsibility for case finding and referral to treatment sources. Of the

reports returned to the schools by such referred children, 42 per cent were signed by private physicians. Here again one observes sectional differences, and in certain areas of the city as many as 80 per cent of the reports are signed by private physicians.

The increasing use of the private physician for the school health examination was not achieved without effort. The parents had to be convinced of the value of utilizing him for this purpose. As was stated previously, the value of the periodic health examination for preschool and school age children is, for the most part, too little appreciated by parents.

The efforts of the Department of Health and the Board of Education took many forms. Prior to the opening of school in September newspaper releases and radio announcements informed the public of the value of periodic health examinations. Parents were urged to take their children to the family physician for such an examination.

Staff conferences and memorandums informed teachers, school nurses and school physicians of the educational objectives of the school health service and of the potentialities of the private physician in a community health program. A quotation from a memorandum from the superintendent of schools, addressed to school principals and teachers, will illustrate the emphasis placed on the health examination by the private physician.

> The school clerk should impress upon the parent, that a physical examination by a private physician is the most desirable form of examination. . . . The new entrant is a stranger to the school physician; whereas, the private physician knows the child and his past history better.
>
> During the past year, there has been an increased number of examinations by private physicians. . . . While this increase is the result of the placing of greater emphasis upon the necessity for this type of examination, there is still a considerable further gain to be expected in the number of new pupils entering school in February, and next September, who will present certificates of medical examination by their private physicians.

Representatives from parent-teacher associations, who assisted in the school registration procedures, also participated in the educational drive for health examinations by private physicians.

In addition to these activities of the Department of Health and the Board of Education the medical practitioners were approached by the county medical societies. Through the medium of the society bulletins and the recent motion picture "When Bobby Goes to School," which is sponsored by the American Academy of Pediatrics, the members of the medical profession were informed of the objectives and the technics of the health examination. To aid the private physician to record his observations, his recommendations and his suggestions for school

follow-up the Department of Health drew up a simple but adequate health record form for his use.

The follow-up of children requiring medical supervision is an important function of the school health service. There are two aspects to the follow-up services which may be rendered. The school is in a strategic position to refer back to their private physicians those parents who have neglected to secure necessary medical care for their children. Second, in the follow-up of children with recurrent or chronic illness the school physician is able to interpret to the school personnel, when necessary, any special recommendations which the private physician may have made. Some of the conditions which may require such special consideration in the schools are rheumatic heart disease, diabetes mellitus, malnutrition, auditory and visual defects and behavior problems.

In the follow-up of a child with a history of rheumatic fever, for example, the teacher would be made aware of the need to be on the alert for the early signs of fatigue. She would be given an understanding of the importance of sending the child home at the first sign of an infection of the upper respiratory tract. If necessary, the child's physical activities would be restricted and supervised. Finally, the school health service would be interested in seeing that follow-up appointments for medical care were being kept.

A survey of private physicians in New York city conducted by the Astoria School Health Study [1] indicated that 94 per cent of them would welcome a follow-up of their patients. A similar survey of pediatricians throughout the country, conducted by the Committee on School Health and School Health Education of the American Academy of Pediatrics,[4] showed that 97.5 per cent were willing to have the school nurse talk with the parent regarding the need for further medical attention. Perhaps it is in the follow-up of children needing continued medical supervision that the degree of cooperation between the school and the private physician is best revealed.

Although the surveys of private physicians' opinion indicate that there is almost complete agreement that the schools should conduct follow-up programs, considerable work remains to be done in this area. Recent studies carried out in New York city of school health records and of private physicians' recommendations for follow-up show the need for better understanding of follow-up objectives and procedures by both school health workers and private physicians. Clarification of policy, definition of procedures and guidance of teachers, school nurses, school

4. Report of Committee on School Health and School Health Education, Seventh Annual Meeting of the American Academy of Pediatrics, J. Pediat. **11**: 140 (July) 1937.

physicians and private physicians are problems in the school health follow-up program which require further study.

When the school broadens its concept of the child and views him in relation to his total environment and when the private physician enlarges his understanding of the function and the services of the school, there will be a basis for a cooperative health program. Through the school the private physician is able to widen his contacts and to serve the community in its health programs. Through the private physician the school is enlisting the support and contribution of an important community group. The health of the school age child is better served when the school and the private physician clarify their respective functions and find a mutual basis for cooperation.

COMMUNICABLE DISEASE AND THE SCHOOL

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In recent years public school health service has been given new impetus. This is, in part, the result of the studies and recommendations of such interested groups as the Joint Committee on Health Problems in Education of the National Education Association and the American Medical Association,[1] the Committee on School Health of the American Academy of Pediatrics[2] and the School Health Policies Committee.[3] Administrators of public school health services throughout the country have been encouraged by such authoritative reports to improve the school medical examination and to give closer attention to the health educational opportunities of the school health service.

The problem of communicable disease, on the other hand, although usually considered by school health committees, has not received the critical medical appraisal enjoyed by some other aspects of the health program. Procedures and policies have changed little from the time when physicians first began to visit schools for the sole purpose of controlling communicable disease. However, the nature of the problem has changed materially—some of the diseases, for example measles and scarlet fever, are milder; specific preventive measures have virtually eliminated smallpox and diphtheria; schools are less crowded, and parents as a rule are better informed both about child care and about the manner in which communicable diseases are spread. Finally, the mortality from the four common communicable diseases has fallen strikingly in the past twenty years.

Red at the joint meeting of the Section on Preventive and Industrial Medicine and Public Health and the Section on Pediatrics at the Ninety-Second Annual Session of the American Medical Association, Cleveland, June 6, 1941.

1. Health Education, Report of the Joint Committee on Health Problems in Education of the National Education Association and the American Medical Association, ed. 3, Washington, D. C., National Education Association of the United States, 1941.

2. The Improvement of School Medical Service, report of the Committee on School Health of the American Academy of Pediatrics, Evanston, Ill., 1940.

3. Suggested School Health Policies, J. A. M. A. **114**:1672 (April 27) 1940.

My purpose in this paper is to suggest three courses of action to be pursued by health and school authorities, namely, (1) to make the legal regulations for the control of communicable disease consistent with modern knowledge about the diseases, (2) to interpret communicable disease in the school as a community problem and (3) to strengthen certain control measures in the school.

If progress in communicable disease control is to keep pace with the improvement made in other phases of the school health service medical leadership, especially by health officers and pediatricians, is necessary.

In 1939 Emerson [4] pointed out that in most states the sanitary codes concerning communicable diseases do not reflect present day epidemiologic knowledge of these diseases. Recently he stated [5] that today not more than eleven states have modernized their codes for the control of

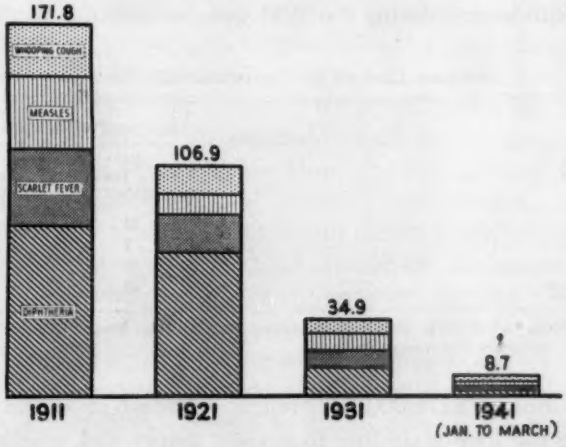

Chart 1.—Mortality from communicable diseases of childhood, 1911 to 1941. The figures represent standardized death rates per hundred thousand for children aged 1 to 14 years (Metropolitan Life Insurance Company, Industrial Department).

communicable disease. Aside from scientific considerations, there is an important practical reason for bringing such regulations up to date. Since they apply to school children, isolation and quarantine periods directly influence school attendance. In the light of present knowledge of the communicability of most of the diseases, the periods of quarantine and isolation have been too long. As more precise information regarding communicability is gained, the trend is toward the shortening of these periods. The table illustrates for some of the communicable diseases the reduction in the time of isolation.

4. Emerson, H.: State Procedures for Communicable Disease Control, Am. J. Pub. Health **29**:701 (July) 1939.

5. Emerson, H.: Personal communication to the author, May 9, 1941.

It is not because of whim or ill nature that the school superintendent views with alarm a poor record of attendance. Like business concerns, schools operate on budgets. Time lost from school by a pupil affects operative costs because of the influence on the pupil's academic work and the loss of state aid. Academic work usually can be made up, but only at some sacrifice of good hygiene. On the other hand, if the pupil must repeat a grade this is a costly business. An equally serious financial loss is occasioned by absenteeism. About 90 per cent of the school systems in this country receive some state aid, which is usually apportioned on the basis of average daily attendance. In New York state 30 per cent of the local school budget is received from the state. For each elementary school child absent the New York city public school system estimates that it loses 26 cents a day.[6] At this rate, the money lost over a three month period during the 1941 measles epidemic in the city was,

Isolation Periods for Communicable Diseases

Disease	Isolation Period, Days from Onset	
	1927 New York State *	1941 American Public Health Association [7]
Chickenpox	12	6 to 10
Measles	7	9
Scarlet fever	30	21
Whooping cough	56	28

* From Wood and Rowell: Health Supervision and Medical Inspection of Schools, Philadelphia, W. B. Saunders Company, 1927.

by rough estimate, $175,000. Therefore, if the isolation and quarantine periods are too long according to present theory and practice it would be of material aid to the school system to have them modified.[6a] However, it is necessary to distinguish between legal isolation and the health of the individual pupil. For example, it may not be advisable for a child recovered from measles whose health is below par to return to school even at the end of the present legal isolation period. This situation must be met on an individual basis.

One step toward bringing school policies and procedures for communicable disease control up to date is to review present school regulations in the light of the recently published recommendations by the Subcommittee on Communicable Disease Control of the American

6. Report of Bureau of Attendance, New York City Board of Education, March 1940.

6a. Many absentees were contacts, who were required to stay out of school for fourteen days from the date of the last contact. Since July 1941 the Sanitary Code of the N. Y. City Heath Department has been revised so that contacts are no longer excluded.

Public Health Association.[7] Since revision of the communicable disease code may have definite financial advantage for the school, it appears an excellent subject for cooperation between the school administrator and the health officer.

THE NECESSITY TO INTERPRET COMMUNICABLE DISEASE AS A COMMUNITY PROBLEM

Cooperation between school and community health authorities is vital if the school health program is to be effective. According to one of the reports of the White House Conference on Child Health and Protection,[8] more than 75 per cent of school health programs are administered by boards of education. Without wise medical and public health guidance school health services under such circumstances may not function in proper relation to the entire community health program. The health officer through his responsibility for communicable disease control has a splendid opportunity to interpret communicable disease as a community problem. For example, the school authorities may believe that the high morbidity among children of school age is the most important aspect of the problem. However, it is obvious from charts 2 and 3 that the highest mortality from the four common communicable diseases which affect school children still occurs in the preschool group. Every physician knows this fact, but is it widely known by educators? One might take whooping cough as an example. An analysis made recently by the New York City Department of Health [9] of deaths from whooping cough occurring among infants under 1 year of age showed that a substantial number had contracted the disease from a child of school age. In spite of the decline for all ages in the mortality from measles, scarlet fever, whooping cough and diphtheria, which is indicated by charts 2 and 3, a proportionately high mortality rate still exists for the preschool and infant age groups. Greater protection, even at the expense of service to the school age group, must be given to younger children. The health officer may help the school administrator to understand that the preschool age is the important period for intensive work. Indeed, the school might do well to stress the advantages of carrying out immunization against diphtheria and vaccination against smallpox in infancy rather than of delaying these procedures until the

7. The Control of Communicable Diseases, Report of the Subcommittee on Communicable Disease Control of the Committee on Research and Standards, New York, American Public Health Association, 1940.

8. The School Health Program, report of the Committee on the School Child, White House Conference on Child Health and Protection, New York, Century Company, 1932, p. 34.

9. Personal communication to the author from the Director of the Bureau of Preventable Diseases, New York City Department of Health.

preschool summer roundup. It might also stress the necessity for the protection of very young children against exposure to older children with even the mildest symptoms and the use of acceptable means of passive immunization if any of the diseases is contracted. With the growing acceptance by educators of responsibility for community educa-

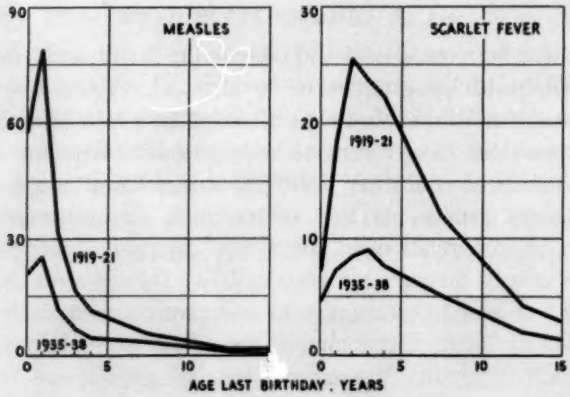

Chart 2.—Mortality from measles and scarlet fever. The curves are plotted to show death rates per hundred thousand white children at ages under 15 years in the United States for 1919-1921 and 1935-1938.

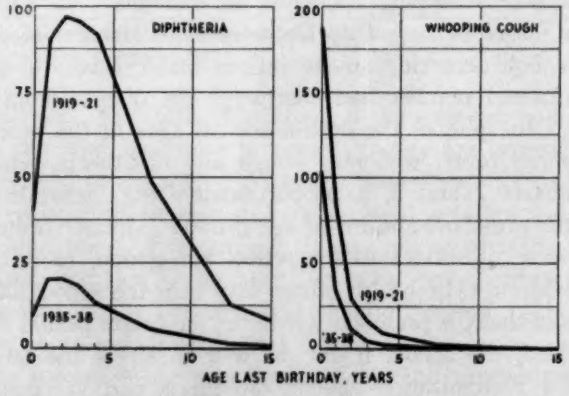

Chart 3.—Mortality from diphtheria and whooping cough. The curves are plotted to show death rates per hundred thousand white children at ages under 15 years in the United States for 1919-1921 and 1935-1938.

tion, this would serve as an ideal health education project to be carried through jointly by the health officer, the county medical society and the school. In congested urban communities during a measles epidemic such public education may be more rational than the futile gesture of control through enforcing quarantine procedures.

THE NEED TO STRENGTHEN IMPORTANT CONTROL MEASURES

Finally, there are important control measures which though accepted as part of the school health program yet do not receive the emphasis they deserve. School authorities generally must not only recognize but believe in the importance of: (1) teacher responsibility for pupil health, (2) closer cooperation between the school and the home and (3) early exclusion of children and teachers who have an infection of the respiratory tract. By acting on these principles the school not only strengthens communicable disease control but raises the tone of the whole school health program.

Teacher responsibility for pupil health is usually discharged with the time-honored morning inspection. This is an important procedure of the school health service. Unfortunately, it is for many teachers a ritual without much meaning, because they receive little or no guidance from the school physician and nurse. To be effective this daily inspection must be conducted by a teacher who is both familiar with the early signs and symptoms of communicable disease and has the opportunity to consult with the medical staff from time to time on health matters. Even the school with the most meager medical service must provide the teacher with instruction; in fact, it is even more important under such circumstances, since health supervision mainly depends on the teacher's knowledge and alertness. Health departments [10] are beginning to recognize the importance of the teacher in the control of communicable disease in the school. A regulation approved a few months ago by the Michigan State Council of Health now authorizes, for the first time, a teacher to exclude from school children with signs and symptoms of communicable disease. In addition to instruction to improve the teacher's ability to recognize signs of illness, the school should, of course, emphasize the teacher's responsibility for the health of pupils throughout the school day.

The second aspect of the communicable disease control program which can be strengthened is closer cooperation between the school and the home. Most school health policies specify that children who are sick must be isolated promptly and then sent home. One of the most unsatisfactory aspects of this procedure, especially in large cities, is the means used to locate a responsible member of the family and get the child home quickly. Frequently the family has no phone or no one is at home. The solution of this problem depends on a closer relation between the school and the home. The principal should have for each pupil, written on his academic record, a brief note of whom to call and what to do in case of illness.

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10. Moyer, H. A.: Michigan Pub. Health **29**:47 (March) 1941.

Another step in the direction of effecting a closer relation between the school and the home is that of having the school fully inform the family why the ill child is sent home and give suggestions regarding the protection of other members of the family if the presence of a communicable disease is suspected. As a measure to protect very young children in the family from contracting measles Brownlee [11] some years ago suggested that schools in Great Britain should record whether the pupil who registers for school is the oldest, an intermediate or the youngest child in the family and whether or not he has had measles. When measles broke out in the class the register was to be consulted, and if the child were not the youngest member of the family, particularly if there were brothers or sisters between the ages of 6 months and 3 years, the school child should, if practicable, be boarded out with relations from the seventh day of exposure until the risk of clinical attack was past. Aside from the question of practicability, the suggestion reminds the school authorities of the seriousness of measles to the preschool child.

Some private schools have demonstrated what it is possible to accomplish in the control of communicable disease when there is close cooperation between the school and the home. The school physician [12] at the City and Country Day School, a private school located in Greenwich Village, New York, has reported that there were no cases of measles in that institution during the recent record-breaking epidemic in New York city. The group of children ranged from nursery school through elementary school age. In the same neighborhood there are public schools, where many children had the disease.

One may question the desirability of completely protecting children of elementary school age from measles. The experience during the last war with the so-called childhood communicable diseases showed that nonimmune adults suddenly exposed to the rigors of camp life are much more prone to suffer the serious complications of these diseases. It was found, for example, that of every 1,000 patients with measles more than 233 had complications, chiefly pneumonia and middle ear infection.[13] The pneumonia was often fatal. Of each 1,000 soldiers with measles, 44 had pneumonia and 19 died, whereas of each 1,000 men without measles, 17 contracted pneumonia and 2 died. (However, Dr. Levine, the private school physician previously referred to, is justified in exercising rigid precautions against measles because he has children of nursery school age under his care.)

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11. Brownlee, cited by Greenwood, M.: Epidemics and Crowd-Diseases, London, Williams & Norgate, Ltd., 1935, p. 194.

12. Levine, M.: Personal communication to the author, April 1941.

13. Michie, M. C.: Measles, in Ireland, M. W.: The Medical Department of the United States Army in the World War: Communicable and Other Diseases, Washington, D. C., Government Printing Office, 1928, vol. 9, pp. 431 and 435.

Early exclusion of children with signs or symptoms of infection of the upper respiratory tract has been advanced at times as a measure to control communicable disease. Stebbins [14] stated that during the season of increased prevalence of scarlet fever it is advisable at least to exclude if not to isolate children with sore throat or an infection of the upper respiratory tract. This procedure, however, is not likely to exert much if any influence on the incidence of measles, chickenpox and mumps in the school if these diseases are current.

An interesting demonstration along this line of thought was conducted by Kaiser [15] about ten years ago in Rochester, N. Y. He found that the attendance record of a school where children with an infection of the upper respiratory tract were promptly excluded was better than that of a comparable school where early recognition of illness and prompt exclusion received no emphasis. In the experimental school twice as many children were absent during the year, but the total number of days of absence was just half that of the control school. The greater number of more serious and prolonged illnesses in the control school kept the children out longer.

Further studies of this type are certainly warranted in view of the growing interest in promoting earlier exclusion of pupils because of colds and the effect that such policies have on state aid for education. While exclusion of the child with a cold is frequently discussed, not much is said about excluding the teacher with an infection of the upper respiratory tract. J. F. Rogers,[16] consultant in hygiene of the United States Office of Education, summed up the situation by saying: "There *does* exist too much insistence on good attendance of both teachers and pupils for their own good and sometimes for the good of others."

It appears, then, that some of the practices for the control of communicable disease in the school need reexamination. Are new methods or technics of control available? Can isolation and quarantine periods be modified? Are the control policies of the school in harmony with the community public health program? The answers require joint action by the school administrator and the health officer. One must look to the health officer to point up the objectives and to the school to face the facts and develop procedures for the school child in terms of the health interests of all the children in the community.

Mr. Mortimer Spiegelman, of the statistical bureau of the Metropolitan Life Insurance Company, assisted in the compilation of the mortality data.

14. Stebbins, E. L.: Communicable Diseases in School, New York State J. Med. **39**:2174 (Dec. 1) 1939.

15. Kaiser, A. D.: Personal communication to the author, April 18, 1941.

16. Rogers, J. F.: Personal communication to the author, April 25, 1941.

RURAL COMMUNICABLE DISEASE PROGRAMS

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The rural health officer has had his administrative problems in communicable disease control somewhat simplified in recent years by the improved organization of community groups interested in this problem. There is a trend in rural areas toward organization of many professional and lay groups on a county-wide basis and toward thinking in terms of county problems. These larger groups show improved leadership as well as a broader interest in community affairs. They encompass many fields and develop programs in the areas of education, health, recreation and other related subjects. The health officer is taking advantage of this trend to work out solutions to communicable disease problems, as well as to educate the people in his jurisdiction.

MAJOR GROUPS CONCERNED IN RURAL COMMUNICABLE DISEASE CONTROL

1. *The County Medical Society.*—County medical societies are showing improved membership and through committees are taking an active part in community affairs. Many rural societies have preventive medicine committees or communicable disease committees, which work closely with the rural health officer in solving problems in the communicable disease field. Most societies also have active program committees, through which the health officer may work in developing educational programs for physicians and in improving their knowledge of communicable diseases.

There is a trend toward the cooperative development of standards by county health departments and rural medical societies. Such standards usually include those affecting communicable disease control.

2. *The County Educational Group.*—School workers are becoming organized on a county-wide basis and offer an excellent group with which the county health officer may work. The group may be a branch of the state educational association, or it may be an independent county organization. It usually is composed of school administrators and the county school commissioner. Rural teachers are often represented.

Read at the joint meeting of the Section on Preventive and Industrial Medicine and Public Health and the Section on Pediatrics at the Ninety-Second Annual Session of the American Medical Association, Cleveland, June 6, 1941.

The county health officer will find the county educational group anxious to contribute to the solution of communicable disease problems and willing to participate actively in the dissemination of communicable disease information.

In the last few months the Michigan Department of Public Instruction, in cooperation with the state health department and local representatives from all over the state, formed a committee to develop policies, including those on communicable disease control. Physicians were represented on the committee. The responsibilities of the school, the physician and the health department were clearly defined. These policies will be sent to every rural teacher in the state.

3. *The County Political Body.*—This is usually a county board of supervisors or magistrates. With the increasing tendency toward county-wide health organization, such boards are becoming better informed on county health problems. With the gaining of information, they have a more favorable viewpoint toward the spending of tax funds for communicable disease programs.

4. *The County Health Department.*—Increasing numbers of counties are developing county-wide health organizations. In such areas there is available the leadership of a well trained physician who has the ability and interest to work with available groups and to take the initiative in organizing communicable disease programs.

5. *Community Lay Committee.*—A fifth group which may be utilized in some areas is the community lay committee. Such committees vary in size and function in each area and have a wide diversification of function and purpose. They may fit into the program of dissemination of communicable disease information and they are usually cooperative in this field.

Comment.—The four groups first mentioned have the major responsibility for communicable disease programs in the community, and their committees can profit considerably by working closely together. The initiative for bringing them together usually comes from the county health officer. It is important that he develop a working relationship with them which will enable him to use their talents and the resources offered by the groups they represent.

The committees should meet at least twice each year to discuss the objectives, the responsibilities and the procedures of the program. They may cooperate in the development of records and printed material. It is important that each committee and the group it represents know what the problems and the procedures in solving them are.

Many rural communicable disease programs could be considerably improved if the interested groups knew the available resources and the procedures to follow.

Education has always been considered the main approach to the solution of communicable disease problems. In addition to being informed on local procedures each group should know its responsibility for the dissemination of communicable disease information.

The rural physician's office is an effective center for disseminating information to the public on communicable disease. The groups should utilize this center for the distribution of printed material. In many counties a county-wide plan of placing pamphlets on communicable disease in physicians' offices for distribution has been successful. The rural physician as an individual may answer many of the questions of his patients by referring them to specific items in printed pamphlets.

The teacher group is always anxious to have specific information on communicable disease, and it will welcome the opportunity for discussions on the subject. It is important that teachers have the points of view of the physician and of the health department. They should be kept supplied with up-to-date and scientifically accurate data on the subject. Because of changing scientific methods, this group often has outdated and inaccurate information.

The teachers and the educational group must have simple and accurate statements from the health department and the medical group on both the procedure to follow when communicable disease situations confront the school and the scientific facts to teach in school.

The committee of the county political body will also welcome information on the communicable disease program. It should be encouraged to take responsibility for keeping the whole political group informed. Many of the problems which arise between the government and the members of the medical profession are due to lack of information on the part of the political group itself.

The health department, of course, is vitally interested in informing the public on the essentials of communicable disease control. It will find that the extensive use of community groups offers many opportunities for improving its educational activities.

Case finding and reporting have been problems in rural areas. Many sick children do not see a physician, and it has been difficult to get medical diagnoses in many cases. The emphasis of the health department has been on getting physicians to report their diagnoses. The major problem, however, is that of getting more of the children who are ill in contact with a physician. The effectiveness of communicable disease programs which have as their objective good reporting, with subsequent good medical and nursing care, depends on the solution of the problem of getting more medical diagnoses for sick children.

The program is made more workable when the financial barrier to securing a diagnosis is eliminated. Most county governments take financial responsibility for the treatment of a diagnosed communicable disease once the diagnosis is established. In southern Michigan, several

county governments have extended this responsibility to include a diagnostic service. Under this program parents and teachers cooperate in getting children who are acutely ill in contact with the family physician. One diagnostic call is available for each sick child, without regard to the patient's financial status. The four committees previously mentioned have cooperated in the plan and have developed the procedures and records. The county government has agreed to pay for the single diagnostic call. Subsequent calls are paid for by the family if they are financially able. All parents understand that the visit to the physician is for diagnosis and that treatment is their own responsibility. Results show that many more children receive medical care for communicable disease than had previously received it.

THE PROGRAM FOR IMMUNIZATION AGAINST COMMUNICABLE DISEASE

Several of these counties have worked out a plan for immunizing children against smallpox and diphtheria in which the family physician takes the responsibility for seeing that all the children in his practice receive preventive treatments.

The program is worked out by the health department and county medical society. It has always been difficult for rural health officers to immunize children in the first few years of life. Immunization statistics in most rural health departments show that it is relatively easy to immunize school children and children of later preschool age. In the counties mentioned, the whole diphtheria-smallpox immunization program is concentrated on children under the age of 2 years.

These health departments have abandoned school immunization programs, and parents are rapidly being educated about the importance of having this work done during infancy. Parents are contacted by mail, by both the family physician and the health department, and are encouraged to take their children to the physician before they reach the age of 2 years. Physicians are developing a standard "tickler" system for systematically notifying parents of the dates on which the work should be done.

The health department has no immunization clinics. It has been found that by the new method it is not difficult to immunize 60 per cent of the infants in rural areas.

SUMMARY

Community groups offer the health officer an opportunity to improve his communicable disease program. This program should include an easily available diagnostic service in which the medical society and the health department cooperate.

Good results can be obtained with programs for immunization against diphtheria and smallpox in which the work is limited to infants and is done by the family physician.

Obituaries

JOHN PRICE CROZER GRIFFITH, M.D.
1856–1941

On July 28, 1941 Dr. Griffith left his office in Philadelphia, feeling well, to go to his summer home in Devon, Pa., but shortly after his arrival there he was stricken with a cardiac attack and died. By his sudden demise the children of this country lost a real friend and benefactor. In these days of turmoil, when the world is full of hate, wars and pestilence, one can reflect on the spirit of Crozer Griffith and take courage in realizing that life still has meaning and can be most worth while. He lived a long life, and at his death he had the satisfaction of knowing that he had fulfilled one of the greatest needs in this world, that of healing children. He did well the work it was possible for him to do.

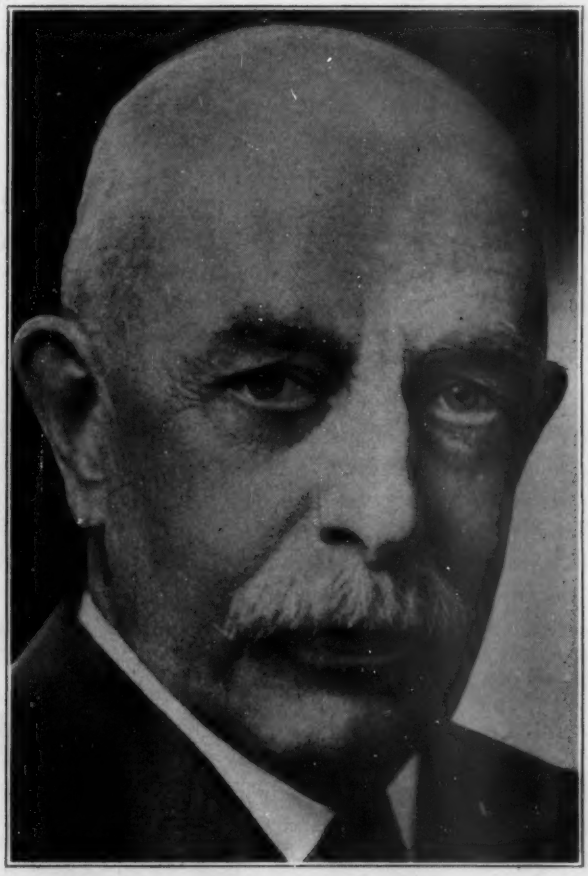
Crozer Griffith was born in Philadelphia on Jan. 5, 1856, the son of Benjamin and Elizabeth Griffith. As an undergraduate he attended the University of Pennsylvania, from which he received the degree of Bachelor of Arts in 1877. He graduated with honors from the University of Pennsylvania Medical School in 1881. He received first prize for his theses for the medical degree and for the degree of Doctor of Philosophy, which he also received in 1881.

After serving his internship, at Presbyterian Hospital of Philadelphia, he spent a year in general practice before going to Europe to do post-graduate work in Berlin and Vienna. On his return to Philadelphia in 1886 he became assistant to Dr. William Osler, and in time he became a member of the staffs of most of the important pediatric services in Philadelphia.

For many years Dr. Griffith was professor of pediatrics in both the undergraduate and the graduate School of Medicine of the University of Pennsylvania and later was appointed emeritus professor in both schools. Few pediatricians in this country have taught as many medical students.

As an author Dr. Griffith was acknowledged as an outstanding authority on diseases of children. He was the author of several volumes on children's diseases and wrote numerous articles in medical journals on clinical pediatrics. His "The Care of the Baby" went through seven editions, and his "Diseases of Infants and Children" went through three, on two of which Dr. A. Graeme Mitchell collaborated. He contributed to Hare's "System of Therapeutics," Starr's "Textbook of Diseases of

Children," Sajous' "Cyclopedia of Medicine," Forchheimer's "Therapeutics of Internal Diseases," Loomis and Thompson's "American System of Practical Medicine" and Keating's "Encyclopedia of the Diseases of Children," for which fifty-one years ago he wrote an 84 page article on "Diseases of the Blood and Blood Making Apparatus." He was editor of the *Transactions of the College of Physicians of Phila-*



JOHN PRICE CROZER GRIFFITH, M.D.
1856-1941

delphia for several years and also edited *International Clinics* at its start. He was a real student and was happiest when working on revisions of his works. He was an indefatigable reader of current literature and was spurred on by the urge to keep his own textbook up to date. His library desk was always covered with manuscripts which he was daily rewriting in order that his books might reflect the latest in current literature.

Among the papers which he read at meetings of the American Pediatrics Society were: Brief Notes on the Use of Antipyretic Drugs in the Febrile Affections of Children (1893); Difficulty in Differential Diagnosis (1895); A Review of the Work of the American Pediatric Society (presidential address, 1903); Sclerema Neonatorum (1905); Weight in the First Two Weeks of Life (1906); The So-Called Thymus Death, with an Account of Six Cases of Sudden Death in One Family (1909); (*a*) Recurrence of Scarlet Fever and (*b*) Duodenal Ulcer in Early Life (1911); Clinical and Pathological Study of Amyotonia Congenita (1911); Infantile Typhoid Fever, Based on the Analysis of Seventy-Five Cases of Typhoid Fever Occurring in the First Two and a Half Years of Life (1912); Diseases Connected with Meckel's Diverticulum, with Special Reference to Diverticulitis (1914); Primary Carcinoma of the Liver in Childhood (1917); Acute Cerebrocerebellar Ataxia, With Reports of Cases (1920); Some Remarks on the Elements of Diet in Infancy, with Special Reference to the Employment of the Czerny and Kleinschmidt Butter-Flour Mixture (1921); A Case of Exanthoma Tuberosum with Diabetes Insipidus (1922), and Displacement of the Heart in Pneumonia (1927).

Dr. Griffith was a member of all the leading pediatric societies and at some time served most of them as president. In the early years of the Philadelphia Pediatric Society he was its mainstay. He was its first president and was also reelected president when the Society celebrated its thirtieth anniversary. He delivered a Frederick A. Packard Memorial Lecture before the Society. He almost always was called on for his opinion on Society matters, and he guided the discussions at the meetings. He was treasurer of the Association of American Physicians for eighteen years. He was president of the American Pediatric Society and served two terms on its council. He also belonged to the American Association of Teachers of Diseases of Children, the American Medical Association, the College of Physicians of Philadelphia, the American Philosophical Society, the Academy of Natural Sciences of Philadelphia and the Pennsylvania Historical Society, and he was corresponding member of the Société de Pediatrie de Paris.

He took a keen interest in various civic enterprises, especially those concerning the welfare of the Baptist church. He was president of the board of trustees of the Baptist Orphanage of Philadelphia, chairman of the board of managers of the American Baptist Publication Society and a member of the board of the Crozer Theological Seminary.

As a teacher, author, clinical investigator and consultant in the field of pediatrics Dr. Griffith's name stands in the front ranks. His chief interest was clinical pediatrics. He was progressive and yet conservative in accepting outright new departures. He was an expert clinical diag-

nostician, keen and accurate, and for many years he enjoyed a large consultant practice. He was always alert for the new and unusual in clinical pediatrics. For years he was the leading pediatrist in the Quaker city, and he furnished a stimulating leadership for hundreds of young pediatricians. During his lifetime he served as visiting physician at St. Agnes Hospital, Howard Hospital and the Children's Hospital; consulting physician at the Women's Hospital and St. Christopher's Hospital for Children, and consulting pediatrician at Abington Memorial Hospital, the Jewish Hospital, Misericordia Hospital and the Babies Seashore Hospital. He was an excellent lecturer and a versatile writer.

Dr. Griffith was greatly admired for his quiet and gentle manner. During his professorship he made daily rounds at the hospital and was always noted for his kindly manner in examining children; this but reflected his character. To him the ward was a constant inspiration. He lived to see more and more effective measures for the cure of sick children put into practice.

He was appreciative of good music and seldom missed the weekly recitals of the Philadelphia Symphony Orchestra and was a regular attendant at the opera. His chief hobby was the cultivation of flowers, in which he qualified as an expert.

In 1882 he married Julia E. Jenks, who died several years before him. Mrs. Griffith always attended the meetings of the American Pediatric Society with him; after her death he discontinued his attendance at the meetings and became an emeritus member.

Pediatrics has need of the work accomplished by Dr. Griffith. He served well the sick children of his community, and his contribution to the care of the sick child was very real. His motive was to bring about among general practitioners a better understanding of the maladies of childhood. He will always be remembered as one who gave his best that sick children might have a fair chance in life.

H. C. C.

News and Comment

GENERAL NEWS

Physicians Certified by American Board of Pediatrics.—The following physicians were certified by the American Board of Pediatrics after the examinations in Boston on Oct. 7 and 8, 1941:

George Edgar Roy Anthony, Flint, Mich.; Joseph Avin, Brooklyn; Edward W. Beasley, Chicago; Helen Wynyard Bellhouse, Thomasville, Ga.; Beatrice Bergman, New York; Charles Bradley, East Providence, R. I.; David Hale Clement, Buffalo; Wallace A. Clyde, Birmingham, Ala.; Stuart Starnes Corbin, Burlington, Vt.; R. Edward Corley, Burlington, Vt.; William Henry Crawford, Upper Darby, Pa.; Bernard S. Denzer, New York; John Devlin Donnelly, Ardmore, Pa.; William Harrison Eberle, Ashtabula, Ohio; Ernest M. Eichhorn, Flint, Mich.; Henry M. Eisenoff, New York; Herman W. Farber, Richmond, Va.; Joseph Andrew Forbrich, Chicago; Albert A. Frank, Malden, Mass.; Martin J. Glynn Jr., New York; Jack R. Hild, Houston, Texas; Oliver William Hill Jr., Knoxville, Tenn.; Marion Hotopp, Dover, Del.; Arthur E. Karlstrom, Minneapolis; Weston M. Kelsey, Westport, Conn.; Irwin J. Klein, Brooklyn; Hedwig Koenig, New York; William O. Kopel, Syracuse, N. Y.; Lawrence Kuskin, Brooklyn; Seymour Kyman, Cleveland; Dorothy M. Lang, White Plains, N. Y.; Robert Barrett Lawson, Chapel Hill, N. C.; Eleanor Isabel Leslie, Evanston, Ill.; Sherman Little, Philadelphia; Clarence L. Lyon, Spokane, Wash.; Thomas Hislop McEachern, Ann Arbor, Mich.; Paul John McGuire, Homestead, Pa.; Thistle M. McKee, Albany, N. Y.; Edwin F. Merolla, Brooklyn; Herbert C. Miller Jr., New Haven, Conn.; Walter Louis Mitchell Jr., Newark, N. J.; Clifton Tate Morris, Baton Rouge, La.; Harry L. Mueller, Winchester, Mass.; Antonio M. Ortiz y Ortiz, Santurce, Puerto Rico; Irving S. Pearlman, Brooklyn; Martin A. Quirk, Red Bank, N. J.; Joseph Raffetto, Asbury Park, N. J.; Frances Elba Myrtle Read, Baltimore; Eleanor Johnson Rector, Akron, Ohio; Franklin Norwood Rogers, Manchester, N. H.; Harold S. Rubin, Hempstead, N. Y.; Victor Rudomanski, Brooklyn; Bernard Schwartzman, St. Louis; John F. Shaul, Bloomfield, N. J.; David W. Sherwood, Boston; H. H. Shuman, Fitchburg, Mass.; Harry Shwachman, Boston; Benjamin Silberg, New York; Lawrence B. Slobody, New York; Arthur H. Spreen, Cincinnati; Nathan Bill Talbot, Boston; Vincent G. Tosti, Ridgewood, N. Y.; Katherine Ver, Dayton, Ohio; Ethel Walker, Baltimore; A. Alvin Wolf, Chicago; J. Andreas Wunderlich Jr., Pittsburgh, and Mary Zeldes, Chicago.

The American Board of Pediatrics.—The dates for the spring examinations of the American Board of Pediatrics have been determined, as follows: March 30 and 31, 1942, in Philadelphia, preceding the meeting of Region I of the American Academy of Pediatrics; April 22, in Los Angeles, preceding the meeting of Region IV of the American Academy of Pediatrics, and May 13, in Cleveland, preceding the meeting of Region III of the American Academy of Pediatrics. The written examinations for those taking the spring oral examinations will be held locally, under a monitor, on February 14.

The fall examination will be held in Chicago at the time of the annual meeting of the American Academy of Pediatrics, probably early in November. The written examinations for those taking the fall oral examinations will be held

locally, under a monitor, approximately six weeks before the date of the oral examination.

Those who wish to take the oral examination in March 1942 must have been registered for it before Nov. 30, 1941; those who take the oral examination on April 22 must have been registered before Dec. 22, 1941, and those taking the May 13 examination must have been registered before Jan. 13, 1942.

Increase in Application Fee for the American Board of Pediatrics.—After careful consideration of the cost of conducting examinations and secretarial expenses, the American Board of Pediatrics has decided to increase its application fee from $30 to $50, effective May 1, 1942. It is the intention of the Board to accept at the old rate of $30 applications from eligible physicians postmarked prior to May 1, 1942.

This action was taken with considerable hesitation and only after it had been demonstrated that the Board cannot continue without an increased income. It will be recalled that early in the Board's experience a large number of pediatricians were passed on record, without examination, and for that reason it was possible to build up a considerable sinking fund. During the past two years this backlog has been seriously reduced, and this step is being taken to prevent the possibility of running out of funds during the next few years, when applications will probably be fewer and expenses certainly no less.

American Orthopsychiatric Association.—The nineteenth annual meeting of the American Orthopsychiatric Association, an organization for the study and treatment of behavior and its disorders, will be held at the Hotel Statler, Detroit, on Feb. 19, 20 and 21, 1942. Copies of the preliminary program will be sent on request. A registration fee will be charged nonmembers.

Section on Pediatrics of the American Medical Association.—The Section on Pediatrics of the American Medical Association will have its headquarters at the Hotel Haddon Hall during the Ninety-Third Annual Session in Atlantic City, N. J., in June. For accommodations communicate with Dr. William J. Carrington, 905 Pacific Street, Atlantic City, N. J.

Fellowships for Research in Nutrition.—A series of fellowships for research in nutrition are being established by Swift and Company, of Chicago, with a view to aiding the federal government in its long range national nutrition program. The fellowships provide for special research to be undertaken in the laboratories of universities and medical schools with funds which the company has set aside as grants in aid and which will be available beginning Nov. 1, 1941. The fellowships are for one year but are subject to renewal if the project warrants it. Any study of the fundamental nutritive properties of foods or the application of basic information about foods to the improvement of American diet and health will be eligible for consideration as a project.

PERSONAL NEWS

Dr. Borden S. Veeder Appointed.—Dr. Borden S. Veeder, of St. Louis, has been appointed a member of the National Board of Medical Examiners.

UNIVERSITY NEWS

University of Birmingham, England.—Dr. Leonard G. Parsons, professor of infant hygiene and the diseases of children in the faculty of medicine at the University of Birmingham, England, who has been acting as deputy dean, has been appointed dean.

Abstracts from Current Literature

Biochemistry; Bacteriology, and Pathology

THE DIFFERENTIATION OF HEMOLYTIC STREPTOCOCCI FROM VARIOUS SOURCES BY THE GROUP PRECIPITIN REACTION AND BY BIOCHEMICAL TESTS. J. B. GUNNISON M. P. LUXEN, J. R. CUMMINGS and M. S. MARSHALL, J. Bact. **39**:689 (June) 1940.

The study made by this group of investigators is very thorough; 561 cultures of hemolytic streptococci were observed. Of this number, 188 were cultures of material obtained from persons with infections, 53 of material from normal persons, 8 of material from infected animals and 312 of raw milk. The cultures were closely examined in order to be sure that a pure strain of the streptococcus was present. By means of the group precipitin reaction and by certain biochemical tests it was found that of the organisms in 241 cultures of material from human sources 156 fell in group A, 13 in group B, 9 in group C, 6 in group D, 1 in group F, 28 in group G, 3 in group H and 25 failed to react with any antiserum. Of the 188 strains associated with infections, 142 were of group A; of 53 cultures not so associated only 14 were of group A. In the majority of cultures in which the organism was not of group A the material came from the throat or the genitourinary tract, and usually there was little evidence that they were responsible for the infection. Of the organisms in 320 cultures of material from animal sources, most of which were isolated from milk, 12 belonged to group A, 263 to group B, 15 to group C, 2 to group D, 4 to group E, 10 to group G, 1 to group H and 13 could not be elassified. All this grouping of the streptococci may have an important bearing on the use of sulfanilamide therapy, because some groups are not susceptible to the action of the drug and some are not sufficiently pathogenic to warrant its use. The authors state that evidence is accumulating which indicates that these differences are associated with differences in serologic and biochemical reactions.

STOESSER, Minneapolis.

THE OCCURRENCE OF MULTIPLE TYPES OF PARATYPHOID BACILLI IN INFECTIONS OF FOWLS, WITH SPECIAL REFERENCE TO TWO NEW SALMONELLA SPECIES. D. W. BRUNER and P. R. EDWARDS, J. Infect. Dis. **66**:218 (May-June) 1940.

"Fifteen outbreaks of paratyphoid infection in fowls in each of which more than one Salmonella type was found are described. In 2 instances 2 paratyphoid species were recognized in cultures from the internal organs of the same bird. In one case three Salmonella species were found in a culture taken from the liver of a single poult.

"Two new serological types of Salmonella are described. One of these, a member of the S. paratyphi B-S. typhi-murium group is designated as S. saint paul. Its antigenic formula is I IV V: eh: 1,2,3. The second is named S. litchfield. It is a member of the S. newport group and its antigens are represented by the formula VI VIII: lv: 1,2,3."

TOOMEY, Cleveland.

TOXICITY OF INTESTINAL VOLATILE FATTY ACIDS FOR YEAST AND ESCH. COLI. OLAF BERGEIM, J. Infect. Dis. **66**:222 (May-June) 1940.

"A study was made of the influence of formic, acetic, butyric and lactic acids on the growth of yeast and Esch. coli to include the range of p_H and acid concentrations likely to occur in intestinal contents. Above p_H 6.5 these acids have relatively little effect. Below p_H 4.0 the p_H in itself becomes important. In the p_H range of 5.0-6.0 where the p_H in itself is not inhibitory, the fatty acids even in low concentrations have a marked effect upon growth. In this range acetic and

butyric acids are the most effective and lactic acid has relatively little influence. Esch. coli is less resistant than yeast and B. acidophilus is very resistant. In studies of the influence of acidity on the intestinal flora the volatile acids must not be disregarded."

TOOMEY, Cleveland.

THE EFFECT OF STAPHYLOCOCCUS TOXIN ON ANTIGEN DILUTION AND ANTIBODY DILUTION PRECIPITIN TITERS IN THE ALBINO RAT. GUY P. YOUMANS and CHARLOTTE A. COLWELL, J. Infect. Dis. **66**:235 (May-June) 1940.

"In the experiments reported, no stimulation of precipitin production in the white rat by staphylococcus toxin was noted. The studies include a total of 108 rats, 54 of which received toxin in addition to the antigen employed. Antigens used were fresh eggwhite, horse serum, dog serum, sheep serum and crystalline hen egg albumin.

"Fresh eggwhite is unsuitable for use as an antigen in rats first, because it reacts with many normal rat serums, and second, because different samples of eggwhite do not give the same results when tested against the same serum.

"In 23 rats injected with sheep serum, precipitin titers by the antibody dilution method were higher than antigen dilution titers in 11 rats, in 4 the titers were the same by both methods, 7 had higher antigen dilution titers and 1 was negative by both methods.

"Twenty rats injected with crystalline egg albumin failed to produce any detectable precipitin."

TOOMEY, Cleveland.

PATHOGENESIS AND IMMUNITY IN ECTROMELIA VIRUS INFECTION OF THE NASAL MUCOSA OF THE RAT. HAROLD R. REAMES, J. Infect. Dis. **66**:254 (May-June) 1940.

"The virus of infectious ectromelia of mice causes an inapparent infection of the rat's nasal epithelium. The virus multiplies, reaching a peak between the third and seventh days, and then disappears. Virus probably does not reach the olfactory bulbs.

"There is no correlation between the disappearance of virus from the nasal cavity and the appearance of detectable amounts of circulating antibodies.

"The serums of rats immunized by the intraperitoneal route contain the same amount of neutralizing antibodies as the serums of intranasally immunized animals. The latter animals, however, are resistant to 'reinfection,' while the former are not. Virus does not gain access to the nasal epithelium, although it is present in the blood and spleen for 24 hours after intraperitoneal inoculation. A single instillation of virus into the nasal cavity is not sufficient to render the nasal tissue resistant.

"No antibodies could be detected in the extracts of nasal tissue of immune rats. A histological study offered no evidence of the mechanism by which the nasal tissue is rendered resistant to reinfection.

"In discussing the mechanism of the acquired resistance of intranasally immunized animals, the idea of an enhanced capacity to produce or concentrate antibody in a strategic area, the nasal tissues, is suggested."

TOOMEY, Cleveland.

Metabolism; Infant Feeding; Milk and Other Foods

APPARATUS FOR MEASURING OXYGEN CONSUMPTION IN HUMAN SUBJECTS AT REST AND AFTER EXERCISE. NATHAN W. SHOCK, ERIC OGDEN and P. M. TUTTLE, Child Development **11**:189, 1940.

For the collection of data adequate for estimating the rate of change in oxygen consumption after exercise an apparatus was designed and constructed which provides for continuous determinations of oxygen consumption over successive

intervals, the duration of which may be varied from one-half minute to three hours. The method involves the collection of expired air in one of a pair of spirometers, while the air expired during the previous period is being automatically measured, sampled and discarded from the other.

In order to provide facilities for varying the oxygen utilization, a bicycle ergometer was designed and arranged so that the subject might operate it with his hands while lying supine by the metabolism apparatus. The ergometer was calibrated so that the amount of work done was automatically recorded. Sample records of performance and recovery from exercise for adolescent children are shown.

AUTHORS' SUMMARY.

THE UTILIZATION OF CALCIUM IN CARROTS, LETTUCE AND STRING BEANS IN COMPARISON WITH THE CALCIUM IN MILK. J. B. SHIELDS, B. W. FAIRBANKS, G. H. BERRYMAN and H. H. MITCHELL, J. Nutrition **20**:263 (Sept.) 1940.

Shields and associates present data from a series of experiments on growing rats, involving the equalization of calcium intakes and of gains in body weight among comparable animals and determination of the calcium retention by analysis of the carcass after an experimental feeding period long enough to permit the animals to gain 100 Gm. in weight. These investigators also compared the availability of the calcium of various vegetable foods and of unpasteurized liquid milk with that of "dry milk solids" at levels of calcium intake insufficient to promote maximum calcification of the bones. Their data showed that the value of calcium in the nutrition of growing animals was not appreciably impaired by the commercial desiccation of milk and that the calcium of milk was definitely better utilized than the calcium from the vegetables tested, which under the conditions of the experiments tended to depress the utilization of the calcium of other foods with which they were fed. The calcium of fresh green string beans was only 74 per cent as available as the calcium of milk, while that of fresh carrots was 85 per cent and of fresh lettuce was 80 per cent as available.

FREDEEN, Kansas City, Mo.

THE INTRAVENOUS ADMINISTRATION OF CRYSTALLINE AMINO ACIDS TO INFANTS. ALFRED T. SHOHL and KENNETH D. BLACKFAN, J. Nutrition **20**:305 (Oct.) 1940.

The purpose of this investigation was to compare the effects of giving intravenously a crystalline amino acid mixture and an enzymatic hydrolysate of casein, with regard to nitrogen balances and temperature reactions. Shohl and Blackfan obtained positive nitrogen balances of the same degree by administration of similar amounts of the two mixtures intravenously. Likewise, the rise in temperature which sometimes accompanies the intravenous administration of amino acids was caused equally by the casein hydrolysate and by the crystalline amino acid mixture.

FREDEEN, Kansas City, Mo.

THE INFLUENCE OF FAT ON CALCIUM AND PHOSPHORUS METABOLISM. JAMES J. JONES, J. Nutrition **20**:367 (Oct.) 1940.

Jones presents data showing that "lard when added to synthetic rachitogenic diets in amounts varying from 5 to 25% had definite antirachitic properties which were not associated with the non-saponifiable fraction." Calcification was increased by adding the lard to diets containing excessive (1.1 per cent) or moderate (0.38 per cent) amounts of calcium. The effect of lard was less pronounced when added to diets containing little (0.02 per cent) phosphorus than when added to those of higher (0.09 per cent) phosphorus content. No antirachitic action was shown by sodium oleate or the calcium soaps of lard, but oleic acid also increased calcification.

FREDEEN, Kansas City, Mo.

THE PREVENTION OF DIETARY DEFICIENCY DISEASES. LESLIE J. HARRIS, Practitioner **145**:105 (Aug.) 1940.

This article is an illuminating discussion of present day conditions in England and should be read in its entirety. The following quotation comprises the final paragraph:

"Unfortunately, as is now being generally recognized, the assessment of the state of nutrition by the routine school medical service is liable to yield incomplete or misleading results. A cursory inspection of a child is not sufficient to reveal the existence of minor or partial degrees of deficiency, and there is neither the time nor the specialized equipment to carry out the more modern tests for assessing the level of nutrition, with respect to specific nutrients, e. g. the saturation tests for vitamins C and B_1, or the dysadaptation test for vitamin A. The child can be weighed and its height measured, but records of the steady improvement in average weights and heights of school children in the past few years show how fallacious has been the practice of taking the *average* for a given area as the *normal* or the *ideal*. More and more the tendency is to recognize that if the family has not available the minimum amount of money needed to nourish the children, the presumption should be made that they are undernourished. It is no longer a heresy, as it was some years ago, to say in the words of the League of Nations Mixed Committee on Nutrition: 'the evidence that inadequency of diet is widespread is conclusive . . . The greatest simple cause of malnutrition is poverty.'"

GELSTON, San Francisco.

NUTRITIONAL VALUE OF RAW MILK AND OF MILK RENDERED FREE OF BACTERIA. Med. Klin. **36**:193 (Feb. 16) 1940.

This article consists of a review of an article concerning nutrition studies on rats, calves and school children. The essence of the article is that pasteurization has no significant effect on the nutritional value of milk. The amount of vitamin B complex was found to be slightly reduced, and the vitamin C content was reduced about 20 per cent. The reduction of vitamin C could be avoided if the milk was not exposed to light and if it was pasteurized in copper-free containers. In studies on children it was found that the muscular power (as determined by a dynamometer) of children receiving pasteurized milk was greater than that of others.

SIEMSEN, Chicago.

Vitamins; Avitaminoses

THE CAROTENE AND VITAMIN A CONTENT OF MARKET MILKS. A. C. DORNBUSH, W. H. PETERSON and F. R. OLSON, J. A. M. A. **114**:1748 (May 4) 1940.

Four types of milk marketed by Wisconsin distributors were tested for their carotene and vitamin A contents over a period of eighteen months. All showed marked seasonal changes in both carotene and vitamin A contents related to the pasture season, the fluctuation in carotene being the more marked. Guernsey milk contained the largest amount of vitamin A in summer because of its higher butter fat content, and certified milk had the highest carotene content in winter because of the use of better feeding (silage) in winter.

"Per quart, the winter milks (January-April) averaged: market, 327 micrograms (1,088 U. S. P. units), Guernsey, 372 micrograms (1,241 U. S. P. units) and certified, 400 micrograms (1,334 U. S. P. units). The corresponding figures for summer (June-October) were 572 (1,906), 727 (2,415) and 599 (1,995)." Vitamin D milk did not differ from market milk in vitamin A content.

HEERSMA, Kalamazoo, Mich.

THE STABILITY OF ASCORBIC ACID IN BLOOD. LOUIS D. GREENBERG and JAMES F. RINEHART, J. Lab. & Clin. Med. **25**:1288 (Sept.) 1940.

The authors show by numerous determinations that whole blood left in a refrigerator does not lose an appreciable amount of its ascorbic acid in two to three hours. Their determinations on plasma and on whole blood in this period showed no wide variations. They found no evidence that the addition of cyanide protects the vitamin from oxidation; in fact, potassium cyanide itself decolorizes 2, 6-dichlorophenolindophenol. Also, they noted that hemolysis should be avoided, since the release of hemoglobin from the red cells produces a decrease or destruction of the vitamin C content of the plasma. The loss caused by hemolysis is not prevented by the addition of cyanide.

GARD, Galveston, Texas.

FAT AS A FACTOR IN THE HEALING OF RICKETS WITH VITAMIN D. ARTHUR KNUDSON and ROBERT J. FLOODY, J. Nutrition **20**:317 (Oct.) 1940.

Knudson and Floody in experiments on rats noted that addition of 5 per cent fat to the rachitogenic diet, which was made up chiefly of purified materials and was extremely low in lipids, resulted in much better healing with administration of a known amount of vitamin D than when there was no fat in the diet. With the addition of 10 or 20 per cent fat the healing was less than with the addition of 5 per cent, but was still greater than when there was no fat in the diet.

When an equivalent amount of calcium in the form of a stearate or an oleate was substituted for all the calcium carbonate in the rachitogenic diet greater healing was produced. However, if only 25 per cent of the calcium carbonate was replaced there was no appreciable difference in healing.

FREDEEN, Kansas City, Mo.

THE DETERMINATION OF ASCORBIC ACID IN EVAPORATED MILK, POWDERED MILK AND MILK PRODUCTS. WARREN W. WAESSNER, C. A. ELVEHJEM and HENRY SCHUETTE, J. Nutrition **20**:327 (Oct.) 1940.

These investigators present analyses of forty-one evaporated milks and nine powdered milks. Data given show that the average American evaporated milk supplies 25 per cent of the quantity of ascorbic acid found in freshly drawn cow's milk; the values ranged from 1.9 to 13.8 mg. of ascorbic acid per liter, which indicates that "evaporated milk is potentially a significant source of ascorbic acid."

FREDEEN, Kansas City, Mo.

A MODIFICATION OF THE LINE TEST APPLICABLE TO CHICKEN VITAMIN D ASSAY. E. W. MCCHESNEY and E. HOMBURGER, J. Nutrition **20**:339 (Oct.) 1940.

McChesney and Homburger present an adaptation of the U. S. P. line test to chick bones which permits a "rapid and accurate determination of the index of calcification and an excellent correlation between the degree of calcification and dietary supplements of vitamin D." Results with this method were also shown to correlate closely with the percentage bone ash determinations, the two criteria giving substantially the same result for the potency of the various preparations of vitamin D tested.

FREDEEN, Kansas City, Mo.

SYNTHESIZED, PROCESSED AND NATURAL SOURCES OF VITAMIN C IN THE MINERAL METABOLISM OF NORMAL CHILDREN. MARION L. SHEPHERD, ICIE G. MACY, HELEN A. HUNSCHER, FRANCIS COPE HUMMEL and others, J. Pediat. **16**:704 (June) 1940.

The present investigation deals with the effects on chemical growth and nutrition of 6 normal children from 5 to 8 years of age produced by supplementing

their adequate daily mixed diet containing 50 cc. of an orange-lemon preparation with 20 mg. of ascorbic acid and by substituting the same amount of fresh orange juice for the orange-lemon preparation. The authors state: "The effects of the diet alterations have been sought in the subjects' retentions of nitrogen and positive (calcium, magnesium, sodium and potassium) and negative (phosphorus, chlorine, sulfur) minerals, and other physiologic reactions."

Growth of both soft and hard tissues of each subject took place during the periods of observation; nitrogen and positive and negative ions were retained. The addition of 20 mg. of ascorbic acid to the diet was accompanied by a reduction in mean retention of total minerals per kilogram of body weight, but the average retentions of calcium and magnesium were increased and all subjects retained greater amounts of cations in relation to anions. Changes in nitrogen retentions were not conclusive. The trends of excretion and retention of the positive and negative ions indicate that the additional vitamin C did permit an increased rate of skeletal formation. Substitution of the fresh orange juice for the orange-lemon preparation improved the nitrogen and mineral metabolism of all subjects to a greater extent, in general, than the addition of the ascorbic acid.

The authors conclude with a discussion of factors which may account for the increased effectiveness of fresh orange juice over the orange-lemon preparation and the greater nutritive advantage of the fresh juice over a vitamin C supplement.

RAUH, Cincinnati.

A SURVEY OF THE STATE OF NUTRITION WITH RESPECT TO VITAMIN C IN A SOUTHERN PEDIATRIC CLINIC. A. S. MINOT, KATHERINE DODD, MARGARET KELLER and HELEN FRANK, J. Pediat. **16**:717 (June) 1940.

"A survey of the ascorbic acid levels in the blood serum of over 500 clinic patients of pediatric age, living in the vicinity of Nashville, Tenn., has been made.

". . . Values of 0.7 mg. and over per 100 c.c. of serum are indicative of a satisfactory state of nutrition with respect to vitamin C. Values of from 0.3 to 0.7 mg. per 100 c.c. indicate a restricted intake. . . . Values under 0.3 mg. per 100 c.c. indicate a serious deficiency of vitamin C.

". . . Approximately 50 per cent of the children without significant diseases are in an unsatisfactory state of nutrition with respect to vitamin C. A greater percentage of 'normal' children under 3 years of age have levels of ascorbic acid under 0.3 mg. per 100 c.c. than in the older groups. . . . During the summer months . . . a considerably larger percentage have serum ascorbic acid values above 0.7 mg. per 100 c.c. than during the winter and early spring.

". . . A much larger percentage of sick children, both with and without diarrhea, show low values of ascorbic acid in serum. Again, in this group, the greater percentage of very low values is found in children under 3 years of age."

The authors remark on the infrequency of clinical evidence of scurvy among the large group who show such a gross deficiency of vitamin C. They suggest that "diets which are simultaneously deficient in calories and several essential food factors may suppress the typical manifestations of deficiency, despite low levels of ascorbic acid which, in otherwise adequately nourished persons, would cause outspoken scurvy."

RAUH, Cincinnati.

VITAMINS: THEIR USE IN CHILDREN. T. J. MARSHALL, Kentucky M. J. **38**:579 (Dec.) 1940.

The author presents a review concerning the use of vitamin A, thiamine hydrochloride, riboflavin, ascorbic acid and vitamins D, E and K.

WEIGAND, Indianapolis.

CLINICAL EXPERIENCES WITH THE MEASUREMENT OF THE URINARY EXCRETION OF VITAMIN B_1. GEORGE A. CARDEN, WILLIAM D. PROVINCE and JOSEPH W. FERREBEE, Proc. Soc. Exper. Biol. & Med. **45**:1 (Oct.) 1940.

Using the thiochrome method of Hennessey and Cerecedo as modified by Ferrebee and Carden (*J. Lab. & Clin. Med.* **25**:1320, 1940), the authors found that the twenty-four hour urinary excretion of vitamin B_1 for 12 adult subjects was 182 micrograms. Increasing the intake of vitamin B_1 by administering 0.5 mg. of thiamine hydrochloride subcutaneously while the subjects consume essentially the same diet increased the urinary output by from 10 to 40 per cent. For the 11 subjects suspected of having vitamin B_1 deficiency the excretion was, on the average, only 26 micrograms in twenty-four hours. In about one half of the cases the increased excretion following the subcutaneous administration of thiamine hydrochloride appeared to be within normal limits, but those subjects with the severest symptoms and signs of vitamin B_1 deficiency had abnormally low increments. The authors believe that the thiochrome method of determining the excretion of vitamin B_1 is a means of determining the state of vitamin B_1 nutrition in man.

HANSEN, Minneapolis.

EFFECT OF ALPHA-TOCOPHEROL ON LESIONS OF SKELETAL MUSCLES IN RATS ON VITAMIN A-DEFICIENT DIETS. CECIL KRAKOWER and JOSEPH H. AXTMAYER, Proc. Soc. Exper. Biol. & Med. **45**:583 (Nov.) 1940.

Degenerative lesions of the skeletal muscles occurred in rats maintained on vitamin A–deficient diets. Since these lesions were similar to those produced in rats reared on a vitamin E–deficient diet, the authors administered wheat germ oil or synthetic alpha tocopherol to rats on a vitamin A–deficient regimen and were able to prevent the lesions in the muscles. These workers therefore believe that vitamin E or alpha tocopherol should form part of the basal diet used to produce vitamin A deficiency in rats.

HANSEN, Minneapolis.

DETERMINATION OF VITAMIN B_1 REQUIREMENT OF INFANTS BY MEANS OF URINARY EXCRETION OF THIAMIN. ELIZABETH M. KNOTT, Proc. Soc. Exper. Biol. & Med. **45**:765 (Dec.) 1940.

Twelve normal infants less than 6 months of age were studied in a total of 98 metabolic periods of five days each. When less than 80 units of thiamine hydrochloride was ingested daily urinary excretion of the substance was at a minimum, while with the daily ingestion of 140 units urinary excretion was increased. These data suggest that the optimum intake for normal healthy infants ranges from 100 to 150 units of thiamine hydrochloride daily. Preliminary studies of the level of cocarboxylase in the blood of several infants tend to substantiate this observation.

HANSEN, Minneapolis.

GRAVIDITY AND VITAMIN C. DANIEL RIBEIRO, Rev. de gynec. e d'obst. **34**:107 (Oct.) 1940.

In this work the author summarizes the principal functions of vitamin C as follows: (1) regulation of endocrine functions, (2) regulation of colloidal state of collagenous material, (3) activation of breathing, (4) influencing glycogenesis, (5) synergic action with glutathione in oxidation-reduction processes, (6) influencing blood clotting, (7) influencing immunologic functions, (8) synergic action with vitamin D in regulation of calcemia and (9) diuretic action.

The author considers that pregnant women need more than a normal intake of ascorbic acid, the minimum requirements being in the order of 100 mg. per day. Tests (of the saturation type) were run on a number of patients who were in the last three months of gestation, urine being taken before and three hours after the injection of 300 mg. of ascorbic acid. Most of the patients were found to have a

deficiency of vitamin C, since none of them eliminated a quantity approaching the usual excretion of 40 per cent of the injected dose. The use of injections of vitamin C is therefore recommended.

Soto, Habana, Cuba.

Use of Massive Doses of Vitamin D in the Treatment of Rickets. J. Bernhard Löper, Arch. f. Kinderh. **116**:248 (April 28) 1939.

A vitamin D_2 (calciferol concentrate was given to 36 children with rickets and a vitamin D_3 (activated 7-dehydrocholesterol) concentrate to 2. The preparation was fed at the beginning of the meal by mixing it with a teaspoonful of milk or by dropping it directly into the mouth of the infant. Doses of 7.5 to 15 mg. were used.

The level of phosphorus as well as the level of calcium in the serum rose forty-eight hours after the massive doses had been given. There was no hypercalcemia, but hyperphosphatemia sometimes occurred. The rickets was cured clinically within two to eight weeks after the massive doses of the preparations were given. The cure was demonstrated by roentgenograms of the carporadial joint and by the disappearance of previously observed craniotabes.

The massive dose of vitamin D is of greater therapeutic value than is the usual administration of viosterol preparations in those cases in which rickets is complicated by a febrile infectious disease, especially bronchopneumonia. Since "hypervitaminosis" was never observed, there is no objection to the massive dose therapy. However, the vitamin D concentrate should be given by the physician and the patient kept under constant observation.

Aron, Chicago.

Calcium, Vitamin D and Rickets. M. Dreszen, Med. Klin. **36**:79 (Jan. 19) 1940.

The author points out that an adequate calcium intake is important and reports "surprisingly good results" with the use of a preparation of calcium and vitamin D. She is convinced that the vitamin B complex contained in the preparation is contributory to general clinical improvement.

Siemsen, Chicago.

Effect of Cooking on Vitamin C Content of Vegetables. T. F. Yü, Chinese M. J. **57**:523 (June) 1940.

The author, from Peiping Union Medical College (China), reports on the analysis of vegetables, raw and cooked, carried on through the cooperation of the dietary service of the college's hospital. The technic was simple. Weighed portions of raw vegetables were cooked, treated and titrated for vitamin C in a manner similar to that used for determinations on the raw vegetables. All vegetables lost a considerable amount (as much as 50 per cent) of their vitamin C content by cooking. The vitamin C content of the same raw vegetables varies from day to day. Storage has a detrimental influence.

Sautéing of vegetables reduced the vitamin content in proportion to the length of cooking time. Vegetable soups lost about half or more of the vitamin C content of the vegetables used in making them. When such soups are cooked on a large scale, as in institutions, they may contain only negligible amounts of vitamin C. One should not calculate the ascorbic acid content of cooked dishes from the value for the raw vegetables they contain, for such calculations produce a false sense of security.

Neff, Kansas City, Mo.

Xerophthalmia Among Children in Batavia. H. de Haas, J. H. Posthuma and O. Meulemans, Geneesk. tijdscher. v. Nederl.-Indië **80**:917 (April 9) 1940.

According to de Haas and his collaborators, 259, or nearly 5 per cent, of the children admitted to the Central Civil Hospital in Batavia, Netherland East

Indies, during the period from 1935 to 1938 had xerophthalmia. More than 40 per cent of the children were either totally blind or blind in one eye. Disorders of the digestive tract occupied a prominent place among the diseases coincident with xerophthalmia, and it is probable that inadequate resorption and insufficient diet play an important part in the pathogenesis of xerophthalmia. Feeding only sweetened skimmed milk was responsible for xerophthalmia in two thirds of the total number of cases in which the patients were children less than 2 years old. An advanced state of dystrophy existed in 75 per cent of the children with xerophthalmia. The vitamin A content of the blood was lower in children with xerophthalmia than in those without it. The use of vitamin A and the continued oral administration of cod liver oil are recommended for the treatment of xerophthalmia, particularly during the early stages. Prophylaxis is more important than treatment; it should be directed toward improvement of the nutrition of the natives, particularly of children of preschool age. J. A. M. A.

Hygiene; Growth and Nutrition; Public Health

HEALTH AND DEVELOPMENT OF A GROUP OF NURSERY SCHOOL CHILDREN. JEANETTE B. MCCAY, ETHEL B. WARING and HELEN D. BULL, Child Development **11**:127 (June) 1940.

Records kept by the parents and the school staff on 66 children comprising the enrolment during five years (1932-1937) in the junior nursery school of the New York State College of Home Economics were utilized to gain an understanding of what the "average" nursery school child is like during the age period from 2 to 3 years. The results, given in the form of medians, interquartile ranges and total ranges, gave information about the feeding and development of the children as infants, their stage of physical and mental development on entering the nursery school, their physical growth and such behavior during the year as their manner of eating at the noon meal and their sleeping behavior at nap time and at night, the amount of outdoor play, their habits of elimination (urination and defecation) and the amount of absence from school caused by sickness during the year.

For the most part the children were favored in their health and development: They were superior in weight at birth and in weight and height when beginning school; their teething occurred early; they were above average in mental development; they were good sleepers, and they had less sickness than has been reported for average children in other nursery schools. AUTHORS' SUMMARY.

A STUDY ON THE TREND OF WEIGHT IN WHITE SCHOOL CHILDREN FROM 1933 TO 1936. MATERIAL BASED ON THE EXAMINATION OF PUPILS OF THE ELEMENTARY SCHOOLS IN HAGERSTOWN, MD. GEORG WOLFF, Child Development **11**:159, 1940.

The data consist of 14,401 weight measurements, of which 7,134 were of boys and 7,267 of girls, made in the four successive years of the observation period. Boys and girls from 6 through 11 years (11 to 12 years) of age exhibited no consistent or statistically significant change in mean body weight during the single calendar years 1933 to 1936. Also, when compared with measurements for a period in the previous decade, the combined years 1921 to 1927, the data show no essential variation in body weight for these ages. The most striking result, on the other hand, is the fact that the older school children, boys and girls 12 years of age and older, exhibit a statistically significant increase of mean body weight. The maximum annual increase, for instance, for 12 year old children amounts to 4.6 pounds (2 Kg.) for boys and 5.2 pounds (2.3 Kg.) for girls. This phenomenon of a real increase is still more significant when the results are compared with those for the former decade. The mean weights for 1933 and 1934 are distinctly below and those for 1935 and 1936 are somewhat above the average of the previous decade. The change in body weight does not vary consistently in the single years.

However, the variability constants for almost all age groups are distinctly higher for girls than for boys. Still more striking is the greater variability in the weight of girls in comparison with that for the period 1921-1927. The considerable increase in weight of the older children is in fairly good agreement with a similar tendency to increase of growth which was observed all over the world and which was especially evident in German school children after the World War. Further figures for the subsequent years are in preparation.

AUTHOR'S SUMMARY.

THE ILLINOIS STATE PROGRAM FOR CRIPPLED CHILDREN. PAUL H. HARMON, Illinois M. J. **77**:579 (June) 1940.

Since the fiscal year 1936-1937, the Division for Handicapped Children in the Department of Public Welfare of Illinois has had available a state-wide field nursing and social service staff to discover children who need plastic surgical and orthopedic surgical care and who can qualify for publicly administered care. Case-finding activities of specialized type have been initiated for persons with congenital deformities and acute poliomyelitis. In one hundred and sixty-eight outpatient clinics held in thirty different places during the past eighteen months, 3,240 children of the total registration of more than 15,000 needing orthopedic or plastic surgical cases were seen. Hospital care has been furnished to more than 1,000 children. The survey for handicapped children and other activities of the field nursing and medical social service department of the state, as well as cooperative activities with other public and private charitable organizations, are described. The funds utilized in establishing and maintaining these services were obtained by matching federal funds, under the provisions for crippled children contained in the Social Security Act.

BARBOUR, Peoria, Ill.

DEATH IN THE FIRST MONTH AND THE FIRST YEAR. CHARLES MCNEIL, Lancet **1**:819 (May 4); 869 (May 11); 912 (May 18); 993 (June 1) 1940.

This report concerns the neonatal records of 2,096 infants and stems from the pediatric section of the Royal Edinburgh Maternity Hospital. Of the 165 stillborn babies, 97 were mature and 68 premature. Of the 114 infants who died in the neonatal period, 46 were mature and 68 premature. The principal direct causes of death in the first two weeks of life are four: congenital defects, asphyxia, intracranial hemorrhage and infection. Behind some of these stand important predisposing conditions, such as maternal disease in pregnancy, difficulty in labor and, most important of all, prematurity. After the first fortnight failure in the management of breast feeding and failure of artificial feeding are chiefly responsible for infant deaths.

LANGMANN, New York.

Newborn

PNEUMOTHORAX IN THE NEWBORN. M. PEHU and R. LEFEBVRE DES NOETTES, Rev. franç. de pédiat. **15**:393, 1940.

The authors have given an excellent discussion of pneumothorax in the newborn. They cite under causes for the condition: (*a*) reanimation of the infant, by mouth to mouth insufflation or the use of tracheal catheter; fracture of the clavicle or the ribs; (*b*) rupture of one or many alveoli as the result of unequal penetration of air during the first respiratory movements, particularly in cases of cerebral hemorrhage, or obstetric causes leading to pulmonary atelectasis; (*c*) tracheal compression by a goiter or a hypertrophied thymus; (*d*) rupture into the pulmonary cavity of a pulmonary abscess or suppurating area of bronchopneumonia, and (*e*) congenital malformations of the bronchi. The condition may occur unilaterally or bilaterally, or it may alternate from one side to the other. Clinically, there are dyspnea and cyanosis which vary in intensity. Hyperresonance may be detected. The roentgenogram is typical. The evolution depends on the

cause and the extent of the compression of the lung. Except when the patient is dying, in which case air may be aspirated from the pleural cavity, no treatment is indicated other than the supplying of oxygen. LESLIE, Evanston, Ill.

APPLICATION OF THE METHOD OF CREDÉ IN THE UNITED STATES. CONRAD BERENS and C. EDITH KERBY, J. d'opht. sociale **2**:44, 1939.

Credé's discovery that one may protect against ophthalmia neonatorum by application of silver nitrate dates from 1880; he published a report on it in the following year. In the United States the first measures in the control of ophthalmia neonatorum consisted in reporting the disease. The first legislation recommended to make application of Credé's method compulsory applied only to "obstetric cases in Almshouses" (Lucien Howe). The first state law in New York was passed in 1890; it required that nurses, midwives, etc., report cases of the disease to the local health department or to a practicing physician. By 1900 twelve other states had followed suit. In 1906 the American Medical Association appointed a committee for the purpose of working out a plan for uniform legislation. From this committee the National Society for the Prevention of Blindness developed later. By 1938 reporting was required by forty-seven states. Free distribution of silver nitrate by health departments started in 1910 (twenty-two states were engaged in such distribution in 1918 and thirty-nine and the District of Columbia by 1938). Statistics on the number of new pupils entering schools for the blind show that the percentage of blindness due to ophthalmia neonatorum has decreased from 28.2 per cent (1906-1907) to 6.7 per cent (1936-1937). It should be noted that the last figure does not show the true present situation, since the children entering schools in 1936 were at least 7 years old.

This same number of the *Journal d'Ophthalmologie Sociale* contains other articles dealing with the history of the care of eyes of the newborn by A. Sziley ("Deutschlands Beitrag und Massnahmen in Kampfe zur Verhütung der Gonoblennorrhoe der Neugeborenen" or, "Some Notes on Prophylactic Care of the Eyes in the Newborn in Old Medical Literature," which mentions the connection between blennorrhea and vaginal discharge, first claimed by Samuel Theodor Quellmaly in 1750; the importance of vaginal treatment of sick mothers which was stressed by Benjamin Gibson in 1870, and a history of Credé's prophylaxis); by Felix Terrien ("L'application en France de la méthode de Credé et de la prophylaxie de l'ophthalmie purulente de nouveau-nés"), and by J. D. M. Cordell ("History of the Care of the Eyes at Birth"). ROSENTHAL, St. Paul.

SEPARATION OF THE PROXIMAL FEMORAL EPIPHYSIS CAUSED BY BIRTH TRAUMA. ARNULF MEIER, Arch. f. Kinderh. **116**:267 (April 28) 1939.

Two cases are reported of the rare occurrence of separation of the proximal epiphysis of the femur by extraction of the baby by the feet. In 1 case full recovery was achieved, and there were no symptoms of deformity or impairment of function. In the second case, that of a premature infant, the patient died of erysipelas at the age of 3 months.

The histologic examination revealed regeneration of bone from the damaged epiphysial line; there was endochondral bone formation as well as perichondral ossification. The bone had started to form a new epiphysial line.

ARON, Chicago.

Acute Contagious Diseases

DIPHTHERIA. EDWIN KLEBS, Bull. Hist. Med. **8**:509 (March) 1940.

This is a reprint from the *Verhandlungen des Congresses für innere Medizin* of 1883. This famous classic was read by Klebs at the second congress, in April 1883. It states in clear language his conviction of the specificity of the diphtheria

bacillus, which he originally called Microsporon diphtheriticum, and gives an excellent clinical and pathologic description of the various forms of diphtheria. A good portrait of Edwin Klebs (1834-1913) accompanies this reprint.

ROSENTHAL, St. Paul.

PERTUSSIS PROPHYLAXIS: A CONTROLLED STUDY. CHARLOTTE SINGER-BROOKS, J. A. M. A. **114**:1734 (May 4) 1940.

Results of the study of 94 children given undenatured bacterial antigen in 1935 were studied by comparing the incidence of exposure and disease for them with that for 77 noninoculated controls. No difference in protection rates was noted.

Similarly, for a group of 330 children given Haemophilus pertussis phase I vaccine (total dose, 80,000,000,000 organisms) by injection the rate was 92 per cent protection of those exposed to the disease as compared with a rate of 2 per cent for the inoculated sibling or familial controls.

The length of time after inoculation and the incidence of the disease in the community are factors determining the attack rate for immunized children.

HEERSMA, Kalamazoo, Mich.

CEREBROSPINAL FEVER. ANALYSIS OF 124 CASES. R. W. CUSHING, Brit. M. J. **2**:439 (Oct. 5) 1940.

A series of cases is reported in which intravenous administration of soluseptasine (one of the sulfanilamide group, disodium p-[γ-phenylpropylamino]-benzenesulfonamide-α-γ-disulfonate) was used. Usually one injection was given, and then oral administration was employed. A second intravenous injection was seldom needed. The mortality was below 3 per cent in this series.

ROYSTER, University, Va.

A SURVEY OF THE BIOLOGICAL TYPES OF THE DIPHTHERIA BACILLUS IN EDINBURGH, 1932-1939. HELEN A. WRIGHT, Edinburgh M. J. **47**:541 (Aug.) 1940.

The author, a member of the department of bacteriology of the University of Edinburgh, Scotland, gives a review of the observations on the types of the diphtheria bacillus. Although there is complete stability of the different biologic types, their relative incidence is constantly in a state of flux and has been observed to vary not only from one place to another but from time to time in Edinburgh since 1932. It has not been disproved that type I (Corynebacterium diphtheriae mitis) is responsible for the clinically mild form of the disease, but epidemiologic conditions might come about which would cause it to have greater virulence. Type II (C. diphtheriae intermedius) for several years has been the cause of most deaths from diphtheria in that city. The data do not substantiate the opinion gained in observations on epidemics of high mortality in English communities that type III (C. diphtheriae gravis) is the most virulent.

NEFF, Kansas City, Mo.

A HUNDRED YEARS AGO—GERMAN MEASLES. R. PATERSON, Edinburgh M. J. **47**:768 (Oct.) 1940.

Dr. Robert Paterson of Leith, Scotland, contributed an article to the *Edinburgh Medical Journal* one hundred years ago concerning an epidemic disease, *Rötheln*, which had not then been described in the English language. He discussed its characteristics as he observed them in an epidemic in his Scottish town and the accounts of the disease in other languages. His description of all the stages of the disease is said to be clear and little seems to have been added to the knowledge of it in the years since his report appeared. He helped to clear up the diagnostic confusion which existed regarding the types of measles and scarlet fever.

German measles is now sometimes regarded as a harmless nuisance which has added unnecessarily to quarantine problems.

NEFF, Kansas City, Mo.

MALIGNANT SYNDROMES DEVELOPING FIFTY-TWO DAYS AFTER ONSET OF DIPHTHERIA. PAUL GIRAUD, PROVANSAL and LOMBROSO, Bull. Soc. pédiat. de Paris **37**:386 (July) 1939.

Usually no sequelae develop as late as fifty-two days after an attack of diphtheria. A boy, 4½ years old, died of postdiphtheritic paralysis and myocarditis on the fifty-fourth day after the onset of the disease. Another boy, 14 years old, died in the same manner sixty days after he had diphtheria. Neither of them had received inoculations of diphtheria toxoid. A third boy, 6 years old, was discharged from the hospital after recovery from diphtheria but was readmitted fifty-one days after the onset of the disease with ocular paralysis, which had been noticed a few days previously, and cardiac arrhythmia. When he was removed from the hospital, on the sixty-ninth day after the onset of diphtheria, he was improving.

BENJAMIN, Montreal, Canada.

OBSERVATIONS IN TWENTY-ONE CASES OF MENINGOCOCCIC CEREBROSPINAL MENINGITIS. A. ARONDEL, Bull. Soc. pédiat. de Paris **37**:390 (July) 1939.

Of 21 patients with meningococcic meningitis, 10 were children under 2 years old, of whom 6 were under 1 year of age. The onset was frequently characterized by symptoms referable to the gastrointestinal or respiratory tract instead of the usual signs of meningeal involvement. There were 3 deaths. Fourteen patients were treated by administration of serum and other measures; the 7 who were treated with serum and sulfanilamide recovered. There were no sequelae.

BENJAMIN, Montreal, Canada.

SCARLATINAL PERICARDITIS. J. CATHALA, P. MARTROU and L. GRAS, Bull. Soc. pédiat. de Paris **37**:401 (July) 1939.

A 10 year old girl had scarlet fever. The temperature remained elevated, and she complained of painful joints on the ninth day and showed evidence of pericarditis with effusion on the twelfth day after the onset of the illness. There was no history of previous rheumatic disease. She recovered.

BENJAMIN, Montreal, Canada.

POSTMEASLES GANGRENE OF THE VULVA. S. GRACOSKI and TITUS MĂRCULESCU, Bull. Soc. de pédiat. de Iasi **7**:47 (Jan.-June) 1937.

During convalescence from measles ulceration and necrotic tissue were noted in the region of the vulva of a 2 year old girl. The child also had bilateral otitis media and bronchitis. When the patient was seen by the authors, the vulva was swollen, hard and painful. Forty cubic centimeters of antigangrene serum was given subcutaneously daily for six days, as well as small injections of blood. Local dressings of rivanol (2, ethoxyl-6, 9-diaminoacutinium hydrochloride) were applied. Recovery followed.

LESLIE, Evanston, Ill.

Acute Infectious Diseases

STUDIES ON THE EPIDEMIOLOGY OF OXYURIASIS. W. SAWITZ, J. S. D'ANTONI, K. RHUDE and S. LOB, South. M. J. **33**:913 (Sept.) 1940.

The inmates of six homes for children in New Orleans were examined for infection with Oxyuris vermicularis by means of the National Institute of Health swab technic. The average incidence of infection was 74.3 per cent, the highest being 96.9 and the lowest 15.9 per cent.

The age incidence showed an increase during the first six years of life. The incidence remained high until the age of 14 years and decreased thereafter. The incidence was slightly lower in girls than in boys under comparable environmental

conditions during the first six years of life, and there was an equally high incidence in the two sexes up to the age of 9 years, after which the incidence in girls fell while that in boys remained high.

The important route of transmission of O. vermicularis appears to be direct contact with infected persons or contaminated objects. SCHLUTZ, Chicago.

THE INCIDENCE OF PINWORM (ENTEROBIUS VERMICULARIS) INFECTION IN NORTH CAROLINA. H. W. BROWN, A. J. SHELDON and T. THURSTON, South. M. J. **33**:922 (Sept.) 1940.

The authors report that several groups of persons were examined for the presence of pinworm (Enterobius vermicularis), by means of the National Institute of Health swab technic.

The examination of 132 underprivileged white boys from Charlotte, N. C., revealed an infection rate of 32.8 per cent. For 67 white patients from the outpatient clinic of Duke University the infection rate was 7.4 per cent. None of 33 Negro patients from this clinic was infected. No infection was encountered among 118 male students from the University of North Carolina.

SCHLUTZ, Chicago.

LOCAL PROTECTION OR IMMUNITY WITH EVIDENCES OF EXPERIMENTAL APPLICATION. W. H. HARRIS and S. WALTHER, South. M. J. **33**:925 (Sept.) 1940.

The authors believe that among the most likely diseases against which local protection might be sought are those in which the main route of infection or portal of entrance is the nasal cavity. These include meningitis, pneumonia and such virus diseases as certain forms of encephalitis and, particularly, the baneful anterior poliomyelitis. Since in the latter disease but little encouragement has been obtained from prophylaxis with preparations of either attenuated or killed virus, there is hope that local protection of the main portal of entry might be afforded by the intranasal applications of a preparation of killed virus.

SCHLUTZ, Chicago.

THE PROPHYLACTIC USE OF TETANUS ANTITOXIN. C. E. NEWELL and C. MCVEA, South. M. J. **33**:962 (Sept.) 1940.

The authors report on a study of 500 patients who received tetanus antitoxin as a prophylactic measure. Of the 500 patients, 9 had had hay fever and 5 idiopathic urticaria. The results of cutaneous tests for a majority of these 14 patients were positive, yet not one of them had a reaction of any kind to the tetanus antitoxin.

A study of seasonal variations showed that the incidence of reactions was highest in May, June, July and August.

The authors believe that there is an apparent increase in the sensitivity to antitoxin in the summer as compared with that in the colder seasons.

SCHLUTZ, Chicago.

CHEMOTHERAPY OF GONOCOCCAL INFECTIONS IN WOMEN AND CHILDREN. MARY MOFFETT, Brit. M. J. **2**:8 (July 6) 1940.

Although this article gives the results of treatment for adults as well as those for children, comment will be limited to the latter. Sulfapyridine (2-[paraaminobenzenesulfonamido]-pyridine) was used in the treatment of gonococcic vulvovaginitis. The dosage employed depended on the age and the development of the child and ranged "from a quarter-tablet four times daily for one week in infants under 3 months to a half-tablet six times daily for one week in the older girls." Daily vaginal swabbing with 10 per cent strong protein silver (protargol) and the

application of bismuth subgallate were suggested. The duration of therapy was three to four months (which in the opinion of the abstracter, is no great improvement over older methods). The number of patients reported cured was relatively small, and the treatment of this disease was considered unsatisfactory. On the other hand, the results of the treatment of gonococcic ophthalmia could be considered not only satisfactory but almost brilliant. ROYSTER, University, Va.

ANAPHYLAXIS AFTER INJECTION OF TETANUS TOXOID. A. A. CUNNINGHAM, Brit. M. J. **2**:522 (Oct. 19) 1940.

A report of anaphylaxis after injection of tetanus toxoid is given, with interesting observations on complications, time of appearance and other matters. An experiment was carried out to test for sensitivity subjects who had had previous injections of toxoid. It is a question whether it is the toxoid or the Witte peptone, in which it was preserved, which is responsible for the reaction; it is probably the latter. ROYSTER, University, Va.

TREATMENT OF TETANUS WITH SODIUM EVIPAN AND M. & B. 693 [SULFAPYRIDINE]. J. BRYANT and H. D. FAIRMAN, Lancet **2**:263 (Aug. 31) 1940.

Twenty-two patients with severe tetanus in Anglo-Egyptian Sudan were treated with sulfapyridine (2-[paraaminobenzenesulfonamido]-pyridine) and by the production of intermittent or continuous narcosis with sodium evipal (a sodium salt of N-methyl C-C-cyclohexamylmethyl barbituric acid). Only 5 died.

It is suggested that when serum is unavailable this treatment may be of great value. LANGMANN, New York.

A NOTE ON THE TREATMENT OF GAS GANGRENE WITH SULPHANILAMIDE AND RELATED COMPOUNDS. E. SINGER, M. J. Australia **1**:796 (June 8) 1940.

Using mice as the experimental animals, Singer found that sulfanilamide and its derivatives exhibited a weak action against Clostridium welchii and Clostridium septicum but afforded no protection against infection with Clostridium oedematiens. GONCE, Madison, Wis.

EXPERIMENTAL STUDIES ON THE COMBINED SULPHANILAMIDE AND SERUM TREATMENT OF GAS GANGRENE INFECTIONS. E. SINGER, M. J. Australia **2**:275 (Sept. 28) 1940.

Singer reports that mice infected with Clostridium welchii and Clostridium septicum can be cured by administration of a relatively small dose of sulfanilamide or one of its derivatives combined with an amount of serum which by itself would be ineffective. The drugs were observed to have an "anti-endotoxic" effect on Cl. septicum. Mice treated with desoxycorticosterone showed an increased resistance (nonspecific) to Cl. welchii. GONCE, Madison, Wis.

STAPHYLOCOCCUS AUREUS SEPTICAEMIA WITH RECOVERY, TREATED WITH M. & B. 693. BERYL D. CORNER, Proc. Roy. Soc. Med. **33**:627 (Aug.) 1940.

The case reported was that of a 10 year old girl who had suffered from cyclic vomiting. The attack came on suddenly with headache, vomiting and pyrexia and lasted over one month. During the course of her illness an abscess of the right foot, pericarditis and osteomyelitis of the upper end of the humerus and of the first metatarsal bone developed. She was treated with sulfapyridine (2-[paraaminobenzensulfonamido]-pyridine). Details of all the investigations and the treatment are given in the report. WILLIAMSON, New Orleans.

INFECTIOUS JAUNDICE IN A BABY OF TWENTY-FIVE DAYS. J. CATHALA and J. ORTHOLAN, Bull. Soc. pédiat. de Paris **37**:409 (July) 1939.

A newborn infant was breast fed for ten days. The mother had lymphangitis of a breast, and he was weaned. When he was 22 days old he had fever and jaundice. He improved gradually, but he was undernourished and had an enlarged liver during the next two months of observation. Infection of the urinary tract with colon bacilli was considered to be a secondary condition, since the infectious jaundice was presumed to be due to the bacteria, probably streptococci, ingested from the infected breast.

BENJAMIN, Montreal, Canada.

Chronic Infectious Diseases

TUBERCULOSIS IN THE ADOLESCENT FEMALE: INFLUENCING FACTORS. J. REGINALD BEAL, Brit. J. Tuberc. **34**:66 (April) 1940.

The figures given in this paper disclose the disquieting fact that while the total number of reported cases of tuberculosis in girls shows a progressive fall, the percentage increase for the age group 15 to 25 years is progressively rising. After analyzing such factors as contact infection, occupation, marriage, housing and income, Beal comes to the conclusion that while all of these must be considered in relation to the increased incidence of tuberculosis in this age group the presence of some other element, such as lack of resistance at this period of life, must not be overlooked.

EUGENE SMITH, Ogden, Utah.

TUBERCULOSIS OF THE KNEE. FOLLOW-UP INVESTIGATION OF OLD CASES. R. C. MURRAY, Brit. M. J. **2**:10 (July 6) 1940.

This report records the results of a statistical study carried out over a period of years. The results are summarized in the following paragraph:

"The following are the more important facts which emerge: (1) Tuberculosis occurs in the knee in about 11 per cent of all tuberculous bone and joint lesions. (2) Synovial tuberculosis progresses to definite bone changes in 45 per cent of cases. (3) There is a high mortality due to other tuberculous lesions in the focal-articular type. (4) The extra-articular lesion on the whole does well."

ROYSTER, University, Va.

TUBERCULOUS CAVITATION IN AN INFANT VACCINATED WITH BCG. S. GRACOSKI and TITUS MĂRCULESCU, Bull. Soc. de pédiat. de Iasi **8**:50 (Jan.-June) 1937.

The infant became noticeably ill with fever and cough at the age of 11½ months. She had received BCG by mouth in the neonatal period. The mother showed no evidence of disease, but the child had been boarded out with 3 different elderly women, 2 of whom coughed considerably. Examination revealed fine rales in the left axilla, and the roentgenogram showed cavitation in the upper lobe of the left lung, enlarged tracheobronchial lymph nodes and a perihilar shadow on the right. The reaction to the tuberculin test was positive, and tubercle bacilli were found in the stomach washings. Severe anemia of the hyperchromic type was also present, and follow-up studies on the blood showed an increased number of eosinophils (37 per cent). The authors believe that such eosinophilia is the expression of a hypersensitivity occurring in association with the development of new foci of infection.

LESLIE, Evanston, Ill.

PARROT'S PSEUDOPARALYSIS IN A PAIR OF TWINS OF THE SAME SEX. E. KUZNITZKY and ALICE KOPPEL, Dermatologica **81**:153 (March) 1940.

Female twins, born prematurely to a mother with latent and untreated syphilis, showed no signs or symptoms of syphilis at birth. In the third to fourth week

mild febrile temperatures were noted. At the age of 6 weeks Parrot's pseudoparalysis appeared simultaneously in the twins, accompanied by coryza and strongly positive reactions of the blood serum. Uniovularity or binovularity of the twins was not determined.

CURTH, New York. [ARCH. DERMAT. & SYPH.]

CLINICAL STUDY OF INVOLVEMENT OF THE NERVOUS SYSTEM IN CONGENITAL SYPHILIS. HERMAN SCHULTE, Ztschr. f. d. ges. Neurol. u. Psychiat. **169**:250 (March) 1940.

Schulte found congenital syphilis in 120 (2.5 per cent) of 4,715 children admitted to a service for child psychiatry. These children were observed from 1926 to 1937 inclusive. Mental deficiency was present in 78 (65 per cent); in 59 per cent the defect was congenital and in 6 per cent it became evident during the first few years of life. Fourteen patients were idiots. Six of the idiots had positive serologic reactions of the blood alone, 1 of the spinal fluid alone and 5 of both the blood and the spinal fluid. Two patients with entirely negative serologic reactions had had adequate treatment in the first year of life, when positive serologic reactions were found. Six patients had microcephaly, 7 convulsions, 2 atrophy of the optic nerve and 5 spastic tetraplegia. Five children had a family history of mental retardation, criminality and alcoholism.

Less pronounced forms of mental deficiency are more characteristic of congenital syphilis. There were 35 imbeciles and 13 children with borderline intelligence. Only 9 of the 35 imbeciles had a good family history. Convulsions were noted in only 5; the serologic reaction of the blood was positive and that of the spinal fluid was negative in 18 cases; that of the spinal fluid was positive and that of the blood was negative in 2 cases; the reactions of both the blood and the spinal fluid were positive in 7 cases and negative in 8 cases. In addition to lymphadenopathy, pallor, Hutchinson teeth, rhagades and other evidence of syphilis, these 35 imbecile children showed the following neurologic signs: macrocephalus, 1; meningocele, 1; external hydrocephalus, 2; adiposogenital dystrophy, 2; signs of involvement of the pyramidal tract, 8; weakness of the facial nerves, 6; weakness of the hypoglossal nerve, 2; hypomimia, 3, and hypotonia, 4. Anisocoria was found in 4 cases, irregular pupils in 4 cases, sluggish pupillary reactions to light in 3 cases and complete pupillary rigidity in 1 case. Nerve deafness was found in 1 case, atrophy of the optic nerve in 1 case, nystagmus in 2 cases and isolated palsy of the trochlear nerve in 2 cases.

There were 13 children with borderline mentality, 5 of whom showed significant character defects. In 8 the intellectual defect dominated the clinical picture. In 3 there was marked physical infantilism. Three patients had had convulsions in early childhood. In 6 cases serologic reactions were negative, with a history of a positive serologic reaction in 2. In 6 cases only the reaction of the blood and in 1 the reactions of the blood and of the spinal fluid were positive. There were 8 children (6.6 per cent) with severe character defects and normal intelligence. Six of these children had defective family histories; 5 showed hyperkinesis, somnambulism, pavor nocturnus and irritability. Of the 5 children, 4 had a positive serologic reaction of the blood; the child with a negative serologic reaction showed pleocytosis and ipcreased protein in the spinal fluid; 2 of the other 3 patients had negative serologic findings. The character defects were mainly in the nature of lying, stealing, attacks of rage and impulsive behavior. There were 4 patients who showed the type of restless, impulsive behavior characteristic of chronic encephalitis in children.

Four children were admitted for neurologic disorders without mental symptoms, evidence of retardation or a character defect; 1 of these had spastic tetraplegia, the second hemiplegia with onset during the fourth week of life, the third spastic paraparesis beginning in the third year and the fourth an extrapyramidal dyskinetic syndrome present since birth. Three patients were admitted because of mental symptoms accompanying severe disturbances of the special senses—1 with blindness due to keratitis and 2 with deafness.

Convulsive seizures were noted in 23 of the 120 cases. In 16 cases convulsions were most prominent in the clinical picture. Of these 16, intellectual defects were evident after the attacks appeared in 10; the serologic reactions were entirely negative in 4; there were a positive reaction of the blood and a negative reaction of the spinal fluid in 4, a positive reaction of the spinal fluid and a negative reaction of the blood in 4 and positive reactions of the blood and spinal fluid in 4. There were spastic hemiparesis in 2 cases, flaccid hemiparesis in 1 case, crossed spastic paresis of the left upper and right lower limb in 1 case and spastic crural monoparesis of the right lower limb in another. There were pupillary anomalies in 6 cases—anisocoria in 3, irregularity in 4, abnormal reaction to light in 4 and inordinate dilatation in 2 cases. Keratitis alone was present in 1 case, keratitis with chorioretinitis in 1, chorioretinitis alone in 3 and chorioretinitis with optic neuritis in 1. The onset of convulsions was most often in the first year (4 cases). In 6 cases the convulsions appeared for the first time between the tenth and the twelfth year. In 7 cases the attacks were of grand mal and in 7 of jacksonian type, and in 2 there were frequent petit mal seizures. In 2 cases the attacks were tonic. In 2 cases there were episodic cloudy states in addition to the convulsions. In all cases some degree of intellectual retardation and enfeeblement existed, in addition to more or less severe changes in behavior.

Juvenile dementia paralytica was encountered in 14 patients, or in 1.5 to 2 per cent of all the children with congenital syphilis in this series. There were 9 boys and 5 girls. Seven of the children with dementia paralytica were retarded mentally before the onset of the paresis; 6 were normal, and no information was available about the premorbid intellectual status of 1. In about half the cases the time of onset of psychotic behavior was more or less clear. The age of onset was between the eighth and the fourteenth year in two thirds of the children. The mode of onset varied greatly—increasing loss of interest, failure in school work, memory defect, speech disturbance, hypersensitivity, silliness, anxiety and attacks of screaming; character defects, such as lying, destructiveness and profanity, were observed. In some cases the onset was with somatic complaints, such as headache, dizziness, insomnia, somnolence, loss of weight, amenorrhea or unexplained sudden rise in temperature. In 1 case the illness began with gradual spastic paresis of one lower limb; in another the patient complained of intolerable sensations of heat at night. Convulsions were noted in 4 cases, and were confined to the right upper limb in 1 case. Eleven of the children were underweight; 1 showed a Fröhlich habitus, and only 2 could be considered to be normally developed. The usual syphilitic stigmas were found as frequently as in the other groups. In 7 cases there was definite hypogenitalism. Four of the children with dementia paralytica showed marked acrocyanosis; 2, status marmoratus involving the limbs, and many of the others, sialorrhea, hyperhidrosis and dermatographism. In 3 cases the thyroid gland was enlarged; in 1 of these cases there was thyrotoxicosis. Pupillary changes were found in all but 2 cases—there were anisocoria in 10 and irregularity in 6; the pupils were moderately dilated in all cases; miosis was not observed; marked mydriasis was seen in 3 cases, and in 9 cases the pupils did not react to light. Two of the patients showed optic atrophy, 1 palsy of the abducens nerve and 2 paralyses of the hypoglossal and facial nerves. Hyperreflexia was noted in 8 cases, and areflexia, with signs of lesions in the posterior columns, in only 1. Six of the children had the dysarthria characteristic of dementia paralytica. Only 1 child had no positive neurologic findings. The mental picture varied. Dulness and apathy, with marked enfeeblement and repetition of senseless phrases were seen in 4 cases; in 1 case there were attacks of destructive and assaultive behavior; in 4 cases there was marked anxiety in strange surroundings; in 2 euphoria with spontaneous overproductivity was noted; in 3 repeated attacks of yelling and screaming occurred, and in 2 marked emotional lability was most prominent. The results of treatment were entirely unsatisfactory.

SAVITSKY, New York. [ARCH. NEUROL. & PSYCHIAT.]

Diseases of Blood, Heart and Blood Vessels and Spleen

PEACOCK AND CONGENITAL HEART DISEASE. THOMAS BESILL PEACOCK (1812-1882). NATHAN FLAXMAN, Bull. Hist. Med. **7**:1061 (Nov.) 1939.

This report serves as a worthy monument to the man who has contributed so much to the knowledge of congenital heart disease. An untiring worker, Peacock devoted most of his time to the investigation of the pathologic anatomy of the various congenital cardiac defects. From 1847, the year the Pathological Society of London, of which he was a founder, was founded, until 1882 (the year he died) he contributed reports every year at its meetings; the majority were concerned with congenital or other cardiac defects.

His outstanding work is "Malformations of the Human Heart," a work of 143 pages which appeared in 1858. It developed from a series of lectures given in 1854 which was subsequently published in the *Medical Times and Gazette*. It was illustrated by 8 plates containing 27 figures. As he stated himself, he aimed "to present the subject in a practical point of view," and he therefore omitted those anomalies which are incompatible with extrauterine life. A second, enlarged (204 pages) and improved edition was printed in 1866. This work contains a wealth of clinical observation and much material on prognosis and statistics.

An important contribution was his description (1860) of contraction and obliteration of the aorta near the junction of the ductus arteriosus, a condition now called coarctation of the aorta. In the same year he published an important original observation on pulmonary silicosis. His work on malformations of the heart "will always stand out as the wedge which opened a closed door to the common understanding of congenital heart disease."

ROSENTHAL, St. Paul.

CORRECTION OF PROTHROMBIN DEFICIENCIES. WILLIAM DEW. ANDRUS and JERE W. LORD JR., J. A. M. A. **114**:1336 (April 6) 1940.

Of 28 patients with prothrombin deficiencies, 26 showed an improved level of prothrombin after the intramuscular injection of 2-methyl-1, 4-naphthoquinone in oil. Of these, 6 were infants with hemorrhagic disease of the newborn who received 0.35 to 1 mg. of the substance. The prothrombin time of these patients improved by 10 to 30 per cent.

HEERSMA, Kalamazoo, Mich.

SPECIFIC SUBSTANCES IN THE URINE OF LEUCEMIA PATIENTS. F. R. MILLER and W. A. HAUSE, Proc. Soc. Exper. Biol. & Med. **45**:387 (Oct.) 1940.

Using a modification of McCullagh's method (*Endocrinology* **22**:120, 1938) for extracting androgens from the urine, the authors obtained extracts from the urine of patients with chronic myeloid leukemia which when injected into guinea pigs caused myeloid proliferation in the liver, spleen, adrenals, lungs and kidneys. Changes also occurred when extracts of the urine of patients with acute lymphoblastic anemia and chronic lymphoid leukemia were injected. Lymphocytic proliferation occurred in the liver, spleen and adrenals of animals given the extract of urine from the patients with chronic disease, and a maturation of the bone marrow was noted in the animals given the extract of urine from the patients with acute lymphocytic leukemia. No specific cellular response occurred when extracts of the urine from 2 normal subjects were used.

HANSEN, Minneapolis.

INFUSION OF BLOOD AND OTHER FLUIDS INTO THE CIRCULATION VIA THE BONE MARROW. L. M. TOCANTINS and J. F. O'NEILL, Proc. Soc. Exper. Biol. & Med. **45**:782 (Dec.) 1940.

Fourteen human subjects were used, ten infusions of citrated blood being given successfully to 7 patients, plasma to 2 and 5 per cent dextrose in physiologic solution of sodium chloride to 4, by the intramedullary route. One of the seventeen

trials was a failure, and in this case little marrow could be aspirated from the sternum and fluid would not run in by gravity. In 2 cases fluid was introduced into the tibia and the femur. From 100 to 1,050 cc. of fluid was injected into these patients, the needle being left in place from one and a half to sixteen hours, and the average rate of flow was 0.4 to 9 cc. per minute. At first some discomfort was noted, but the patients were comfortable when fluids were being injected. No constitutional reactions were observed, and roentgenograms showed no evidence of subsequent disturbance. Intramedullary pressure varied between 50 and 120 mm. of water.

HANSEN, Minneapolis.

PRODUCTION OF PERNICIOUS ANEMIA-LIKE SYNDROME IN RATS WITH BILE ACIDS. RAPHAEL ISAACS, Proc. Soc. Exper. Biol. & Med. **45**:794 (Dec.) 1940.

In 3 of 12 rats given injections one to six times per week of a suspension of glycocholic acid prepared from ox bile a mild macrocytic, oval red blood cell anemia developed during the course of two months. Two of these animals showed ulceration of the skin, and in 1 dragging of the hindlegs and a clumsy gait developed. These symptoms did not appear in the control groups or in the animals given simultaneous injections of liver extract. Preliminary studies on human subjects revealed that bile acids are increased in the blood of patients with pernicious anemia, an observation made by Blankehorn (*Arch. Int. Med.* **19**:344 [March] 1917).

HANSEN, Minneapolis.

STERNAL MARROW PUNCTURE IN CHILDREN. M. DIWANY, Arch. Dis. Childhood **15**:159 (Sept.) 1940.

Roentgen and gross examinations of the human sternum were carried out to determine the developmental stages of the centers of ossification and to discover the correct depth to which the needle should be plunged in order to reach the marrow cavity. The details of the technic of sternal puncture are discussed. A study of the marrow of 10 normal children from 3 years 6 months to 5 years 5 months of age and of 5 infants from 1 to 2 years old was carried out. The results may be summarized as follows: The total nucleated cell count varied from 75,000 to 160,000 per cubic millimeter. There was a definite predominance of myeloid elements. The myeloid-erythroid ratio ranged from 4 to 6, and in cases 4 and 7 it was 9 and 13 respectively. The proportion of neutrophil segmented forms was generally low, in 6 of the 10 cases being below 10 per cent and in the rest about 15 per cent. The myelocytes, the metamyelocytes and, to a lesser degree, the staff forms make up the greatest percentage of the myeloid elements. In Kato's series the proportion of fully mature segmented forms was small, being less than 7 per cent. The percentage of eosinophils was high; in 5 cases it ranged between 4 and 9 and in 2 was 10 and 13 respectively. The relatively high percentage of lymphocytes in most of the cases was striking. The counts for the cells of the red series displayed a great variation, ranging from 5 to 18.5 per cent. In most cases the values were lower than those obtained by Kato for the same age groups (18 to 25 per cent). The majority of the cells were erythroblasts, while in Kato's series most of the cells were normoblasts. Megaloblasts were absent in all cases. Early erythroblasts in mitosis were frequently seen. The number of myeloblasts averaged only from 0.25 to 2 per cent. Megakaryocytes were invariably present.

KELLY, Milwaukee.

RHEUMATIC HEART DISEASE IN IDENTICAL TWINS. C. BRUCE PERRY, Arch. Dis. Childhood **15**:177 (Sept.) 1940.

The cases of 2 pairs of apparently identical twins are described. In the first case both children had attacks of rheumatic fever after a sore throat but only 1 had scarlet fever. In the second case acute rheumatism and carditis developed in only 1 child although the 2 children had been brought up together. It is concluded

that while heredity is of considerable importance in the causation of acute rheumatism another factor, probably infection, plays a role of equal, if not greater, importance.

KELLY, Milwaukee.

STUDIES ON STORED BLOOD: II. THE LEUCOCYTES. ANDREW CROSBIE and HAROLD SCARBOROUGH, Edinburgh M. J. **47**:553 (Aug.) 1940.

This second contribution gives the methods and results of studying the duration of motility of the white corpuscles and the rate of their disappearance during the first ten days of storage. The conclusion is reached that 75 per cent of the polymorphonuclears originally present are still motile (viable) at the end of twenty-four hours of storing but that only 5 per cent have not disintegrated when the blood has been stored as long as five days.

NEFF, Kansas City, Mo.

STUDIES ON STORED BLOOD: III. THE OXYGEN CAPACITY. HAROLD SCARBOROUGH and J. C. THOMPSON, Edinburgh M. J. **47**:567 (Aug.) 1940.

This third communication on stored blood is of interest to the clinician, whose purpose in giving a transfusion is to increase the oxygen-carrying power of the patient's blood. The methods of study are mentioned, and the results from their application are portrayed in a series of graphs. The conclusions reached are that storage for periods up to thirty days does not seriously impair the content of hemoglobin or the oxygen-carrying capacity of blood. This investigation was financed by the Moray Fund of Edinburgh University, Scotland.

NEFF, Kansas City, Mo.

ACUTE LEUKEMIA: A CLINICAL AND HAEMATOLOGICAL STUDY. A. PINEY, Edinburgh M. J. **47**:616 (Sept.) 1940.

A series of cases was studied in order to include all the signs of the disease, for in a single case one does not often find every feature of the clearcut picture. The following characteristics may be recorded: rare occurrence after the age of 20 years and greater frequency in males; acute, fulminating onset; irregular fever; severe anemia from the beginning; lymphadenopathies; nodules in skin, mucosa or retina; splenomegaly; swelling or ulceration of gums; hemorrhages in retina, skin or subcutaneous tissue and into or from mucous membranes; 100 per cent mortality, and death as early as six weeks after onset.

Of 9 cases reported, the first 2 were of children, aged 7 and 3 years respectively. The older child was thought to have rheumatism at first, but after the pains disappeared fever persisted, the spleen was found to be greatly enlarged and attention became centered on small "bruises" on the legs and on the fact that the sternum was tender to light percussion. Examination of the blood showed a positive oxidase reaction and the picture of acute myeloblastic leukemia, but the course was not fulminating, the disease lasting fifteen weeks. A case of chronic myeloid leukemia in a child has probably never been recorded.

The 3 year old child had an enlarged liver, free fluid in the abdomen, readily demonstrable temporal retinal hemorrhages and tenderness of the sternum; small myeloblasts made up 98 per cent of the leukocytes, which numbered 500,000 per cubic millimeter, and were described as "Chosrojeff's micromyeloblasts."

The other cases were all of adult patients, 3 being above 60 years of age and 4 in middle life. The author concludes that "atypical" forms are more common in acute leukemia; that clinical differences between myeloid, lymphatic and monocytic types are not constant, and that therefore this malady is not a clinical entity. While the basis of classification rests only on the three varieties of blood picture, types or syndromes can be picked out on the basis of the symptoms in certain cases.

NEFF, Kansas City, Mo.

HEMOGLOBIN STANDARDS IN CHILDREN AND ADOLESCENTS. (HEMATOLOGICAL STUDIES IN INDIANS). E. L. NAPIER and C. R. DAS GUPTA, Indian J. M. Research **28**:207 (July) 1940.

The hemoglobin content of 5 year old boys is about 11.5 Gm. per hundred cubic centimeters of blood, and that of 16 year old boys is 13.5 Gm. (The value for adults, 15 Gm., is reached during the twenty-fifth year.) The hemoglobin content of girls is the same as that of boys up to the eleventh year, but it rises to the adult level of about 12.5 Gm. very slowly.

SNELLING, Toronto, Canada.

PURPURA AND DISTURBANCES OF THE SYMPATHETIC NERVOUS SYSTEM. H. GRENET, Bull. Soc. pédiat. de Paris **37**:454 (Jan.) 1940.

The nervous system, especially the neurovegetative part, is believed to be involved in the pathogenesis of purpura and its intestinal manifestations.

BENJAMIN, Montreal, Canada.

A CASE OF NIEMANN-PICK DISEASE IN AN EIGHTEEN MONTH OLD INFANT. P. ARMAND-DELILLE, ABRICOSSOFF and JOUSSEMET, Bull. Soc. pédiat. de Paris **37**:464 (Jan.) 1940.

An 18 month old boy had a large spleen, which had increased in size rapidly. The skin was café au lait in color. The liver was not enlarged. The erythrocytes numbered 3,600,000 per cubic milimeter of blood and the white cells 15,000, of which 58 per cent were polymorphonuclear. Examination of the blood showed 1.33 Gm. of free cholesterol and 0.67 Gm. of cholesterol ester per hundred cubic centimeters. The maternal grandfather had diabetes. The urine showed double refractile bodies. Material obtained by splenic puncture contained numerous large cells filled with lecithin, which are typical of the disease.

BENJAMIN, Montreal, Canada.

HEMATOLOGIC DATA FOR PERUVIAN CHILDREN. VITALIANO MANRIQUE V., Rev. d. Hosp. d. Niño **1**:23 (March) 1940.

The author gives the results of a well carried out study of over 500 children of different ages (newborn to 3½ years old) in the health centers at Lima, Peru ("gotas de leche"), all of them from humble environments. His results are as follows:

Erythrocyte Count.—The number of erythrocytes showed a clear drop after birth. There was no relation between the number of red cells and the body weight. Infants with physiologic anemia due to the iron-deficient diets of the mothers were observed, the anemia appearing most frequently between the ages of 1 and 5 months. The average values according to age were: first few days, 4,870,000 per cubic millimeter; 1 month to 2 years, 4,580,000, and 2 to 3½ years, 4,460,000. The values varied but seemed to be slightly lower for girls than for boys of the same age.

White Blood Cells.—The average values according to age for the total white cell count were: newborn, 10,900 per cubic millimeter; 1 month to 2 years, 12,900, and 2 to 3½ years, 11,170. The average values according to age for the eosinophil counts were: newborn, 3.25 per cent; 1 month to 2 years, 4.43 per cent, and 2 to 3½ years, 4.82 per cent. A high protein diet favors a rise in eosinophils. The presence of intestinal parasites was ruled out by microscopic study of the stools. The number of basophils was uniform for all ages, the average being 0.22 per cent. In the first few hours of life there is always a clear predominance of neutrophils. The average values according to age for the neutrophil counts were: newborn, 36.2 per cent; 1 month to 2 years, 41.4 per cent, and 2 to 3½ years, 45.9 per cent. The average incidence of J forms according to age was: newborn, 0.5 per cent; 1 month to 2 years, 0.39 per cent, and 2 to 3½ years, 0.43 per cent. The average incidence of stab forms by age was: newborn, 2.04 per cent; 1 month to 2 years,

3.21 per cent, and 2 to 3½ years, 4.47 per cent. The average counts for segmented forms, by age, were: newborn, 33.62 per cent; 1 month to 2 years, 37.76 per cent, and 2 to 3½ years, 40.97 per cent.

The average values for the monocyte counts, according to age, were: newborn, 7.25 per cent; 1 to 24 months, 3.20 per cent, and 2 to 3½ years, 2.26 per cent.

The average values for the lymphocyte counts, according to age, were: newborn, 52.17 per cent; 1 to 24 months, 61.47 per cent, and 2 to 3½ years, 49.68 per cent.

In some smears plasma cells were observed.

Schilling Index (deviation).—The value is variable but is always higher than that for adults and very often it is close to unity.

Hemoglobin Content.—There was no sexual variation. The average values, according to age, were: 1 to 6 months, 68.5 per cent (11.0 Gm. per hundred cubic centimeters); 6 to 12 months, 71 per cent (11.4 Gm.), and older than 1 year, 70 per cent (11.25 Gm.). The weight had a slight influence and the diet a great but not constant influence on the values. The average value for globular hemoglobin was 29 micrograms.

Other Data.—The average color index was 0.9 and the average blood reticulocyte count was 1.6 per cent, or 46,500 cells, per cubic millimeter of blood.

JESÚS LOZOYA, Mexico City, Mexico.

ETIOLOGY OF STASIS IN THE REGION OF THE PORTAL SPLENIC VEIN IN CHILDREN (SPLENIC VEIN STENOSIS). KURT KRUYK, Jahrb. f. Kinderh. **149**:137 (June) 1937.

Case histories of the author in addition to those gathered from the literature are presented. Illustrative roentgenograms are included.

Esophageal bleeding is the most characteristic symptom. This is accompanied by splenic enlargement and is often followed shortly by leukopenia, thrombopenia and, frequently, profound secondary anemia.

Among the causes listed are the following: (1) compression of the vein walls from inflammatory conditions, such as tuberculous glands, and anomalies in the veins; (2) thickening of the vein walls, which leads to the formation of thrombi, and (3) lodging of thrombi from a distant source in the veins in question as a result of some such condition as sepsis or cachexia. Various other subheads are given in the etiologic classification.

Splenectomy is the treatment of choice.

LANDAU, Hannibal, Mo.

Diseases of Nose, Throat and Ear

HEREDOPATHIC COMBINATION OF A CONGENITAL DEFORMITY OF THE NOSE AND OF MYOCLONIC TORSION DYSTONIA. L. BENEDEK and E. RAKONITZ, J. Nerv. & Ment. Dis. **91**:608 (May) 1940.

Benedek and Rakonitz report the heredofamilial occurrence of combined developmental retardation of the nasal bones and a form of myoclonus and torsion dystonia in three generations of the same family. A mother and her 2 sons, all affected, were examined; her maternal aunt was known to have had the same abnormalities. The nasal anomaly consisted of a median nasal groove, similar to that seen in certain anthropoid apes (Simia satyrus L.), with hypoplasia of the minor and major alar, the septal and the lateral cartilages. The motor disturbances consisted of rapid, spontaneous, arrhythmic, involuntary contractions of the broad, flat muscles of the shoulders, neck and back, without resulting motion of the extremities (myoclonus) and, in addition, torsion spasm of the muscles of the neck and trunk. The patients examined also exhibited enlargement of the accessory nasal and mastoid cavities and infantilism and sclerotization of the larynx. The nasal and laryngeal abnormalities were equally manifest in all the affected persons,

but the intensity of the motor disturbances varied from one patient to another. Emotional factors influenced both the myoclonus and the torsion dystonia. Benedek and Rakonitz consider the whole complex heredopathy to be due to a developmental disturbance of the mesencephalon and diencephalon during the first three or four months of embryonic growth.

MACKAY, Chicago. [ARCH. NEUROL. & PSYCHIAT.]

TONSILS AND ADENOIDS. LANCELOT BARRINGTON-WARD, Practitioner **145**:309 (Nov.) 1940.

The author concludes as follows:

"To sum up, it may be stated that the pathological effects of the tonsils are neither so black nor so white as they have been painted. Absolute indications for tonsillectomy cannot be laid down, and the evidence requires careful sifting before judgement is given. In properly selected cases its performance confers a lasting benefit on the individual."

GELSTON, San Francisco.

DIAGNOSIS OF MASTOIDITIS IN THE INFANT BY PUNCTURE OF THE ANTRUM. H. GRENET, LALLEMANT, L'HIRONDEL and BOELLE, Bull. Soc. pédiat. de Paris **37**:438 (July) 1939.

A needle and a trocar with the guard raised to prevent its entering too far are inserted into the mastoid antrum as a diagnostic aid in the cases of infants suspected of having mastoiditis. An antrum found to contain air which circulates freely through it is considered normal. If mucopurulent secretion is present a diagnosis of mastoiditis is made and treatment instituted. A few drops of solution of sodium chloride may be injected, aspirated and examined to determine if pus is present. No untoward effects have been encountered. The lateral sinus was punctured on one occasion, but no unfavorable result ensued.

BENJAMIN, Montreal, Canada.

SYMPTOMATOLOGY OF STUTTERING. ALFREDO DUB, Rev. méd. latino-am. **25**:1135 (July) 1940.

The cause of stuttering may be systemic or psychic. In the form of systemic, or somatic, origin there is a disturbance of respiration. The abdominal and thoracic muscles function independently and not synchronously, as they do in normal breathing. The involuntary muscular movements which accompany the difficulty in breathing are spasmodic; they may be either tonic or clonic. The facial muscles are involved, so that the patient uses various gestures, and unintentional movements accompany his efforts to express himself. It is difficult to differentiate between symptoms of systemic and those of psychic origin, because they are closely related. For example, a person may not stutter in one environment, while at another place he can be understood only with difficulty. Respiratory curves showing alterations observed in cases of stuttering illustrate the article.

DWYER, Kansas City, Mo.

CLINICAL ASPECTS OF ACUTE INFECTIOUS DISEASES IN CHILDREN AFTER TONSILLECTOMY. MAX REGER-TUSKAN, Jahrb. f. Kinderh. **150**:91 (Oct.) 1937.

There was no real difference in the course of scarlet fever in the two groups of children (those who had and those who had not undergone tonsillectomy). There was also no difference in the incidence of rheumatic complications. The tosillectomized group showed a greater incidence of otitis media. A connection between otitis media and nephritis was not evident in these studies. There was a lower incidence of secondary diphtheria in the tonsillectomized group, and the course was generally more favorable. The number of patients dying from septic or toxic scarlet fever was less in the tonsillectomized than in the nontonsillectomized group.

The author found fewer instances of diphtheria among the children whose tonsils had been removed. Severe pharyngeal diphtheria was but little less frequent among those with tonsils. Croup was more frequent in the tonsillectomized group. Nasal diphtheria occurred about three times as frequently in patients with tonsils. He was unable to come to definite conclusions regarding the influence of the presence of tonsils on the carrier state.

It was difficult to reach definite conclusions regarding measles, because in general the children whose tonsils had been removed were in the older age group, in which the course tends to be more favorable under any circumstances.

Pertussis was not unfavorably influenced by tonsillectomy.

LANDAU, Hannibal, Mo.

Diseases of the Gastrointestinal Tract, Liver and Peritoneum

THE SEX INCIDENCE OF PEPTIC ULCER IN CHILDREN. HARRY C. SALTZSTEIN, AARON A. FARBMAN and DAVID J. SANDWEISS, Endocrinology **27**:400 (Sept.) 1940.

A study of the sex incidence of peptic ulcer in children was prompted by recent studies which seem to show that a relation exists between the secretions of the gonads and peptic ulcer in adults.

To determine whether some protective factor is absent in girls before puberty, the cases of 105 patients between the ages of 1 and 12 years reported in the literature were analyzed. Of the patients, 54.3 per cent were boys and 45.7 per cent girls, a ratio of almost 1:1. It is well known that after puberty ulcers occur in females only one-fifth as often as in males. Androgens and estrogens are excreted in increasing amounts from the age of 3 years on. The patients were divided into two age groups, and it was found that girls predominated in the younger group (aged 1 to 6 years), while in the older age group in which androgens and estrogens were excreted in greater quantities, the proportion of boys was greater, approaching figures for adults.

JACOBSEN, Buffalo.

THE TREATMENT OF COLIC IN INFANTS. FRANK C. NEFF, J. A. M. A. **114**:1745 (May 4) 1940.

Colic, which is recognized as a possible manifestation of the startle reflex of infants, is indicated by attacks of intense crying, which are assumed to be due to abdominal pain. Factors tending to lessen its occurrence are regularity of feeding, quiet, removal of swallowed air, use of the prone position and administration of sedatives for a few days. Soluble phenobarbital, atropine sulfate and codeine sulfate are suggested. These suggestions do not apply to cases in which there is vomiting, diarrhea, improper feeding or illness.

HEERSMA, Kalamazoo, Mich.

SEVERE GASTRO-ENTERITIS: RECOVERY AFTER MASTOIDECTOMY. J. B. ATKINS, Proc. Roy. Soc. Med. **33**:626 (Aug.) 1940.

The case reported is that of a 5 month old infant.

WILLIAMSON, New Orleans.

USE OF MILK FERMENTED BY LACTOBACILLUS ACIDOPHILUS IN THE TREATMENT OF DIARRHEA IN INFANCY. H. GRENET, DE PFEFFEL, P. ISAAC-GEORGES and A. WIMPHEN, Bull. Soc. pédiat. de Paris **37**:411 (July) 1939.

Infants with diarrhea were fed milk fermented by Lactobacillus acidophilus with good results. When a concentrated culture of the bacilli was administered instead of milk containing the organisms the results were not as good.

BENJAMIN, Montreal, Canada.

USE OF MILKS FERMENTED BY STREPTOCOCCUS ACIDI LACTICI OR BY LACTOBACILLUS ACIDOPHILUS IN THE TREATMENT OF GASTROENTERITIS IN INFANTS. L. GUILLEMOT and C. JÉRAMEC, Bull. Soc. pédiat. de Paris **37**:414 (July) 1939.

Milk fermented by either of the bacteria mentioned gave good results when fed to infants with digestive disturbance. The milk fermented with Lactobacillus acidophilus was not taken as well by the infants as that soured by Streptococcus acidi lactici, probably because of the higher content of lactic acid in the former.

BENJAMIN, Montreal, Canada.

DIAPHRAGMATIC HERNIA WITH ANEMIA. H. GRENET, P. ISAAC-GEORGES and COMBES-HAMELLE, Bull. Soc. pédiat. de Paris **37**:420 (July) 1939.

A 5 year old boy had a diaphragmatic hernia on the right side. The stomach was situated posteriorly in the right hemithorax, with the pylorus toward the left, giving it the appearance of a mirror image of a normally placed stomach. There was marked anemia, which responded to the usual treatment; the chief complaint was pallor. It is pointed out that in many cases diaphragmatic hernia has been reported to be associated with severe anemia.

BENJAMIN, Montreal, Canada.

ABDOMINAL PURPURA AND INTUSSUSCEPTION. JULIEN HUBER, J.-A. LIÈVRE and NÉRET, Bull. Soc. pédiat. de Paris **37**:427 (July) 1939.

An 8 year old boy was admitted to the hospital after being ill for fifteen days. He had purpura and some nausea and vomiting. He became progressively worse and died three days later after passing blood per rectum, which was thought to be due to intestinal purpura. Necropsy revealed intussusception.

BENJAMIN, Montreal, Canada.

CASE OF ESOPHAGEAL ULCER IN AN INFANT OF ELEVEN MONTHS. E. LESNÉ, DENISE RONGET and SUZANNE LONGEAUX, Bull. Soc. pédiat. de Paris **37**:455 (Jan.) 1940.

An 11 month old boy had vomited since birth, at times soon after feedings and at other times between feedings. The vomitus usually contained mucus and dark blood clots in addition to undigested food. Esophagoscopic and roentgenologic examinations revealed the presence of an esophageal ulcer situated 5 cm. below the aortic narrowing. It measured about 1 by 1 cm. There was a slight dilatation of the lower part of the esophagus with some narrowing just above it, but no diverticulum was visualized. When the patient was given a diet of milk there was much less vomiting. It was believed that gastrostomy would be necessary later, to put the esophagus at rest and allow the ulcer to cicatrize.

BENJAMIN, Montreal, Canada.

DIAPHRAGMATIC HERNIA OF THE GREATER CURVATURE OF THE STOMACH. H. GRENET, GAUTHERON and AUPINEL, Bull. Soc. pédiat. de Paris **37**:476 (Jan.) 1940.

A 6 month old boy had vomited since birth, usually soon after feedings. The vomitus consisted of coagulated milk and mucus and at times was streaked with bright red blood. Rarely, the blood was dark. While he was in the hospital melena occurred, although it had not been observed previously. Roentgenographic examination revealed the presence of a hernia of the greater curvature of the stomach, a pocket of which was situated above the diaphragm adjacent to the cardiac shadow.

BENJAMIN, Montreal, Canada.

A CASE OF DIAPHRAGMATIC HERNIA. SEBASTIAN PINELES, Bull. Soc. de pédiat. de Iasi **10**:22, 1939.

The diaphragmatic hernia in the case under consideration was not discovered until the patient was 4½ years of age. She had always been constipated and had

vomited a great deal. A barium meal showed moderate elevation of the pylorus, which was thought to account for the vomiting, and also a loop of the transverse colon entering the thoracic cavity on the left in front of the heart. The condition was thought to be congenital.

LESLIE, Evanston, Ill.

A CASE OF VON GIERKE'S DISEASE. MARIE CAMNER and T. MĂRCULESCU, Bull. Soc. de pédiat. de Iasi **10**:31, 1939.

The case under consideration was that of a girl 4 years of age who had seemed normal until the appearance of convulsions at the age of 2 years. These became less and less frequent, but marked enlargement of the abdomen was noted. At first the disorder was thought to be Gaucher's disease or Niemann-Pick disease, but the spleen did not share in the enlargement and although the level of cholesterol in the blood was high (300 mg. per hundred cubic centimeters) no characteristic cells were found. The fasting blood sugar was low, and there were acetonuria and marked sensitivity to insulin. Because of these observations, although the response to the administration of epinephrine was normal, the authors feel that the case belongs in the group described by von Gierke and designated by his name.

LESLIE, Evanston, Ill.

Nervous Diseases

CHOROID PLEXUS TUMORS IN INFANCY AND CHILDHOOD. CARL W. RAND and DAVID L. REEVES, Bull. Los Angeles Neurol. Soc. **5**:31 (April) 1940.

Rand and Reeves report 4 cases of tumor in the lateral ventricle occurring in infancy or childhood. Three of these tumors, in patients aged 5 years, 2 years and 21 months respectively, were classified as "choroidoependymal tumors" and 1, in a child aged 13 months, as a papilloma of the choroid plexus. In all cases, the signs and symptoms were those of rapidly increasing intracranial pressure, with varying amounts of ataxia, rigidity of the neck and attacks of generalized muscular rigidity and opisthotonos. High temperature was a feature in 2 cases; xanthochromic, bloody fluid was obtained by ventricular or spinal puncture in 2 cases and clear fluid in another. Clinically, in all cases the tumor was thought to be in the posterior cranial fossa, although a ventriculogram eventually demonstrated a cerebral tumor, mistakenly thought to be a cystic glioma, in 1 case. Suboccipital exploration was carried out in 2 instances. At autopsy the tumors were observed to be large, fragile, vascular and hemorrhagic. The 3 choroidoependymal tumors were rich in cuboidal or columnar cells arranged in sheets or forming perivascular pseudorosettes without other connective tissue stroma. In 2 of the 3 tumors blepharoplasts were seen and a tendency to form tubules was noticed. Glial fibrillae were formed in 1 tumor. The papilloma of the choroid plexus, on the other hand, exhibited hyperchromatic cuboidal or columnar cells forming numerous papillae with connective tissue stalks and without blepharoplasts. Rand and Reeves point out that the clinical diagnosis of tumors of the choroid plexus is difficult, the conditions for which they are mistaken including hydrocephalus, subarachnoid or subdural hemorrhage and cerebellar tumor. Only by means of ventriculographic examination revealing xanthochromic fluid and a filling defect can the preoperative diagnosis and localization of such tumors be made with certainty.

MACKAY, Chicago. [ARCH. NEUROL. & PSYCHIAT.]

DILANTIN SODIUM IN THE TREATMENT OF EPILEPSY. S. I. FRANKEL, J. A. M. A. **114**:1320 (April 6) 1940.

Forty-eight patients with epilepsy, including several children, were treated with dilantin sodium. Personality changes were less frequent with the use of this drug than with the administration of phenobarbital and bromides, and there was no

sedation. The seizures of 19, or 39 per cent, of the patients were entirely controlled, those of 10 were partially controlled and 19 showed little or no change. Hyperplasia of the gums, paralleling the drop in ascorbic acid in the blood, was present in 30 cases.

HEERSMA, Kalamazoo, Mich.

EPILEPSY: NEWER METHODS OF INVESTIGATION AND TREATMENT. WILLIAM G. LENNOX, J. Lab. & Clin. Med. **26**:232 (Oct.) 1940.

The newer methods of diagnosing this condition, including the electroencephalographic examination, are discussed. There is also a brief consideration of the various methods of treatment.

GARD, Galveston, Texas.

SOME NEUROLOGICAL COMPLICATIONS OF SERUM THERAPY. A. R. THOMPSON and J. B. L. TOMBLESON, Brit. M. J. **1**:1015 (June 22) 1940.

Involvement of the nervous system complicating serum therapy is stated to be not at all common. Peripheral neuritis has been noted following prophylactic injections of tetanus antitoxin. The central nervous system is also involved at times, and in such cases the injection is followed promptly by collapse, vomiting and, rarely, coma and may be succeeded eventually by hemiplegia, hemianesthesia, or other protean sign. Optic neuritis, cranial nerve palsies and in fact involvement of almost any cranial or peripheral nerve may follow administration of the serum. Mental changes, which more or less resemble states of confusion may also be noted. Administration of antistreptococcus or antiscarlatina serums is very rarely followed by any nervous involvement. The authors state that they have discovered only 10 such cases in the whole of the literature. Two illustrative cases are reported at some length. They are too long, in fact, to be abstracted suitably.

ROYSTER, University, Va.

THE CLINICAL AND BACTERIOLOGICAL ASPECTS OF MENINGITIS DUE TO H. INFLUENZAE. WILLIAM HAYES, Irish J. M. Sc., June 1940, p. 241.

The author previously considered this a relatively rare fatal disease. Study of statistics shows that it ranks third or fourth in incidence among the acute meningitides. The course is subacute, lasting from ten to twenty days. Occasionally arthritic complications are seen. The diagnosis is made by finding pleomorphic organisms in the direct smear and in cultures on chocolate agar. The organism also grows on blood agar as a satellite to staphylococcus. The smooth type of colony is characteristic of the pathogenic influenza organisms whereas the rough form does not cause meningitis. In treatment sulfapyridine (2-[paraaminobenzenesulfonamido]-pyridine) or sulfanilamide was used with azosulfamide and soluseptasine (disodium p-[γ-phenylpropylamino]-benzenesulfonamide-α-γ-disulfonate). Repeated spinal drainage was carried out. One patient of 4 recovered with this treatment. The author states that antiserum may be of value but because of the complexity of the methods of producing it and the variety of types and strains of organisms used, it is not generally available. He stresses the importance of early treatment and also the tendency to local abscess formation.

SNELLING, Toronto, Canada.

SYSTEMATIZED DEGENERATIVE DISEASE OF MOTOR AND SENSORY NEURONS RESEMBLING AMYOTROPHIC LATERAL SCLEROSIS. MARCEL LELONG, IVAN BERTRAND and JEAN LEREBOULLET, Bull. Soc. pédiat. de Paris **37**:424 (July) 1939.

A woman who had been thought to have amyotrophic lateral sclerosis seven years previously, when she was 16 years old, now showed some signs of this disease as well as others which were suggestive of hereditary cerebellar ataxia. The case is considered unique, and it is pointed out that amyotrophic lateral sclerosis in a child under 16 years of age is very rare.

BENJAMIN, Montreal, Canada.

SYNDROME OF RADICULONEURITIS OF GUILLAIN-BARRÉ TYPE IN A TWELVE YEAR OLD GIRL. P. ARMAND-DELILLE, ABRICOSSOFF and JOUSSEMET, Bull. Soc. pédiat. de Paris **37**:468 (Jan.) 1940.

A 12 year old girl had an acute infection which was followed by marked muscular weakness and tenderness. There was no sensory disturbance, and the reflexes were not abolished. The girl showed progressive improvement. The spinal fluid contained an increased amount of protein without any increase in cells. The diagnosis of infectious radiculoneuritis was made and the prognosis of complete recovery given.

BENJAMIN, Montreal, Canada.

CASE OF A SYNDROME OF CEREBRAL TUMOR IN A THIRTEEN YEAR OLD CHILD, WITH A COMMENT ON PITHIATISM. G. BOUDET, J. BALMES, J. BARNAY, JEANJEAN and BOUGAREL, Bull. Soc. pédiat. de Paris **37**:486 (Jan.) 1940.

A 13 year old girl complained of symptoms characteristic of tumor of the brain. For eight months she had severe headache and could not stand or walk. The spinal fluid was normal. There were no abnormal physical signs, and encephalographic examination revealed no abnormality. Roentgenograms showed less aeration of the sinuses on the right side than of those on the left. She also had enuresis. By means of suggestion she was gradually cured of her hysteria.

BENJAMIN, Montreal, Canada.

MENINGITIS DUE TO STAPHYLOCOCCUS AUREUS; CURE FOLLOWING TREATMENT WITH SULFANILAMIDE. H. JANET, ODIER-DOLLFUS, A. WIMPHEN and R. LEFEBVRE, Bull. Soc. pédiat. de Paris **37**:490 (Jan.) 1940.

A boy was admitted to the hospital at the age of 6½ months with signs of meningitis; this was his second hospitalization. Staphylococcus aureus was found in smears and cultures of the spinal fluid. An ear drum was incised, but no discharge ensued. Sulfanilamide was administered intrathecally and into the lateral ventricle as well as orally. After the fifth day spinal fluid cultures were sterile. The highest concentration of sulfanilamide in the spinal fluid was 14 mg. per hundred cubic centimeters. The infant weighed 6.9 Kg., and he received an average dose of 2 Gm. daily by mouth for the first ten days. This dose was gradually diminished until administration of the drug was stopped about a month after the onset of the disease. He recovered. It is of interest that he had been discharged in good condition from the hospital about two weeks prior to his second admission after a stay of four days following repeated convulsions. Lumbar puncture at that time was unsuccessful, sanguineous fluid being obtained.

BENJAMIN, Montreal, Canada.

COMBINED CHARCOT-MARIE-TOOTH AMYOTROPHY AND FRIEDREICH'S DISEASE IN SEVERAL MEMBERS OF A FAMILY. LUDO VAN BOGAERT and M. MOREAU, Encéphale **2**:312 (June) 1940.

Van Bogaert and Moreau describe the cases of an uncle and nephew with similar symptoms suggesting the combination of amyotrophy and Friedreich's disease. Of the mother's 5 children, 2 daughters were healthy and the third, the mother of the second patient, had dementia paralytica. The first son died at 33, with intense atrophy of the legs and bilateral "clubfoot." The second son, the authors' first patient, is now 40. He was unable to walk until 9 years of age. No progression of the disorder was apparent. Examination showed marked kyphoscoliosis, legs of the pipestem type, with atrophy extending into the thighs, and a high arch with dorsiflexion of the big toes. He could stand only on a wide base. The tendon reflexes were absent in the arms and legs; the abdominal reflexes were brisk, and the plantar response was absent. (All these observations were duplicated in the examination of the nephew.) Complete anesthesia was present over the area of distribution of the internal popliteal nerve, and a boot of anesthesia

was found over the lower portions of the legs. Vibration and position sense were poor in the legs. Speech was poorly articulated. There was no dysmetria or nystagmus.

The second patient, who is now 26 years old, was born prematurely at 8 months, had convulsions at the age of 10 months, walked when 30 months old and never went to school. Clubfoot was noted bilaterally at the age of 11, kyphoscoliosis soon after and gradual atrophy of the lower portions of the legs at 14, with no further change after the age of 20. Examination showed a spastic-ataxic gait, with veering to the right. Some pseudohypertrophy of the muscles of the arms and marked amyotrophy of the legs were present. The tendon reflexes were absent in the limbs, the abdominal reflexes were brisk and the plantar response was not obtained. Vibration sense was very poor in all the limbs, and position sense was poor in the feet. Touch and temperature perceptions were poorly appreciated from the feet to the calves. Bilateral degeneration of the external popliteal nerves was demonstrated by electrical tests (reaction of degeneration). Biopsy of a nerve-muscle preparation showed marked demyelination and muscle atrophy. This case was unlike the first in that nystagmus and hypermetria were present.

HOLT, Worcester, Mass. [ARCH. NEUROL. & PSYCHIAT.]

CLINICOANATOMIC STUDY OF A CASE OF SYDENHAM'S CHOREA. M. T. CALLEWAERT, J. belge de neurol. et de psychiat. **40**:5 (Jan.) 1940.

Callewaert states that there is as yet no conclusive opinion regarding the nature of the pathologic changes in Sydenham's chorea. Some authors believe the process to be inflammatory, while others regard it as purely degenerative. In an attempt to clarify the matter, she presents the clinical and pathologic report of the case of a 15 year old girl in whom chorea developed in association with acute rheumatic fever and endocarditis. The outstanding pathologic changes in the nervous system were as follows: There was intense, generalized congestion of the brain, most marked in the hypothalamus, the periventricular area and the corpus striatum, but also present in the cerebral and the cerebellar cortex. There were small hemorrhagic areas in the cerebral peduncles and the substantia nigra. There was no cellular infiltration in the perivascular spaces. There was a mild subcortical glial reaction in the white matter of the cerebrum and cerebellum. There were degenerative changes in the small cells of the caudate nucleus and putamen, the hypothalamic region, the red nucleus, the subthalamic nucleus and the amygdaloid nucleus and less marked changes in the rolandic cortex, the dentate nucleus and the reticular substance in the medulla. In these same areas there was moderate glial infiltration. Callewaert states that these cellular alterations, together with the glial reaction, are degenerative. It is possible that the intense congestion and the hemorrhagic changes are inflammatory, but she believes them also to be degenerative.

The author regards Sydenham's chorea as a toxic-infectious process in which the toxic element is largely predominant. When they exist, inflammatory lesions are always moderate, discrete, well localized and associated with degenerative changes. The differences between the changes which suggest inflammation and those characteristic of degeneration are too minimal to indicate two types of chorea. The variations observed in individual cases are probably indicative of the degree of virulence of the disease in its acute stages or of the individual reaction to the etiologic process.

DE JONG, Ann Arbor, Mich. [ARCH. NEUROL. & PSYCHIAT.]

CEREBRAL TUMOR WITH SECONDARY HYDROCEPHALUS. S. GRACOSKI and TITUS MĂRCULESCU, Bull. Soc. pédiat. de Iasi **8**:60 (Jan.-June) 1937.

The patient, a 2 year old girl, developed normally until she was 20½ months old, when she showed trembling of the arms, lack of strength, lack of appetite and slight fever. A week later hemiplegia developed on the right and was followed by aphasia and tetraplegia. When seen in the clinic she had exaggerated exten-

sion of the lower extremities and contractures of the upper extremities. She paid little attention to her surroundings and would neither eat nor drink. There was complete atrophy of the optic nerves. The Wassermann reaction was negative, as was the reaction to the tuberculin test. Ventriculographic examination showed enormously dilated lateral and third ventricles. Methylene blue (methylthionine chloride) did not pass into the spinal fluid. Postmortem examination revealed a glioma which completely surrounded and compressed the aqueduct of Sylvius.

LESLIE, Evanston, Ill.

INFANTILE ENCEPHALOPATHY OF THE FÖRSTER TYPE. T. MĂRCULESCU, Bull. Soc. de pédiat. de Iasi **10**:18, 1939.

The author presents the case of an 8 year old child with poor psychosomatic development who since the age of 3 years, when a febrile episode occurred, had shown the following cardinal symptoms: (1) muscular hypotonia when lying on the back, (2) athetoid movements of the fingers of the left hand, (3) hypertonia so marked that there was contracture of the muscles of the lower extremities when the patient was held erect, (4) exaggeration of the knee jerks and positive Babinski reactions and (5) language difficulties and some mental defect.

LESLIE, Evanston, Ill.

THERAPEUTIC EXPERIENCE WITH VITAMIN K FRITZ HAUSER, Ann. pædiat. **155**:325 (Sept.) 1940.

"1. Using vitamin K in the hemorrhagic diseases of the newborn, we had the same favourable results as the previous authors. There may be a failure of the treatment if there is a synchronous thrombocytopenia and diminished blood calcium. These cases need additional transfusions of blood and injections of calcium salts. Four of our 7 cases had thrombopenia, 2 had hypocalcaemia. The frequent occurrence of thrombopenia in the hemorrhagic conditions of the newborn has been described by other authors. (*Eckstein, Beumer.*)

"2. Two cases of atresia resp. stenosis of the bile ducts with hemorrhagic symptoms were treated with vitamin K. It was possible to operate one of those cases after vitamin treatment, the other one recovered without operation. We applied a synthetic preparation of vitamin K (Synkavit Roche).

"3. Vitamin K was successfully used in a case of thrombasthenia *Glansmann* which developed severe hemorrhagic symptoms. In a similar case without hemorrhagia, we were able to demonstrate that vitamin K influences not only the production of prothrombin, but also the retraction of the blood clot which is remarkably increased. This was proved as well in a case of hemorrhagic aleucia

"4. In the case of thrombasthenia without bleeding, the vitamin K seemed to enhance the fibrinogen content of the plasma, while lack of the vitamin diminished it. In 6 healthy children, there was no effect of vitamin K on the fibrinogen content of the plasma.

"5. Observations under 3. and 4. justify the use of vitamin K in thrombopenia and thrombasthenia in addition to blood transfusions.

"6. While measuring prothrombin time, we used with good results decalcified human milk as a source of thrombokinasis. Normal blood gives a prothrombin time of 20 to 60 seconds, mostly 30 to 35 seconds. (Micromethod after *Quick, Kato, Fiechter.*) Milk giving more than 45 seconds with normal blood was excluded."

AUTHOR'S SUMMARY.

ACUTE ENCEPHALITIS IN CHILDREN; A CLINICAL AND SEROLOGICAL STUDY OF TEN EPIDEMIC CASES. F. T. CHU, J. P. WU and C. H. TENG, Chinese M. J. **58**:68 (July) 1940.

This communication comes from the division of pediatrics of Peiping Union Medical College. The disease affected infants and children of all ages. In the

case of the youngest patient, who was 4 years old, the diagnosis was based on the results of examination of the spinal fluid, which showed pleocytosis, an increase in the protein content, a normal sugar content and the absence of micro-organisms, and the simultaneous occurrence of other cases. Symptoms and physical signs included fever, tremor, strabismus, positive Kernig and Babinski signs and rigidity of the neck. There were 3 deaths. The youngest patients had a mild form of the disease.

The neutralization test with virus was carried out in 6 cases. In 4 instances the serum protected white mice against the Japanese virus, and in 3 of these 4 cases tests showed protection against the St. Louis type of the virus as well.

NEFF, Kansas City, Mo.

Psychology and Psychiatry

THE NATURE AND CHARACTER OF PREADOLESCENT GROWTH IN READING ACHIEVEMENT. CECIL V. MILLARD, Child Development **11**:71 (June) 1940.

This study illustrates the possibilities in the use of a mathematical equation in describing various phases of child growth and development. The use of the equation is predicated on a continuing program of measurement of the individual child in an effort to note qualitative, as well as quantitative, aspects of growth.

By utilizing reading scores on the Stanford tests over approximately a five year period the growth patterns of some 120 children were studied. The equations derived from observed performances were found to picture the reading development of the entire group within a mean deviation of ± 3.0 from the actual measures.

Other observations of general interest were those relating to the effect of sex and of intelligence on performance in reading. No significant differences were found between boys' and girls' scores. The children, both boys and girls, with higher intelligence quotients were found to be growing toward higher maximums and likewise began and ended the preadolescent reading cycle at earlier ages than those with lower intelligence quotients.

In all instances, wide differences were found between an individual pattern of growth and growth as represented by the Stanford norms. The combined curves of all the subjects ("curves of constants") and the individual curves illustrate the fact that growth in reading is represented by certain curvilinear characteristics which are not comparable with the approximate straight line norms of the Stanford tests.

AUTHOR'S SUMMARY.

THE ATTITUDES OF AGGRESSIVE AND SUBMISSIVE BOYS TOWARD ATHLETICS. W. FAUQUIER, Child Development **11**:115, 1940.

In order to follow up the impression which had been gained that enthusiasm and preference for athletics among institutionalized boys seemed to be related to the type of person, that is, to his problems and, especially to his conduct, an athletic questionnaire was given to the institutionalized boys. The boys had been separated on the basis of behavior record into two groups: (1) aggressive and (2) submissive. For control purposes a normal group of junior high school boys was similarly tested. On the basis of a reliable statistical difference between the quantitative scores it was qualitatively pointed out that the aggressive boys prefer competitive group athletics, which satisfy their hyperactive and dominance-seeking natures. The submissive boys voice more interest in noncompetitive, individually played games, pretend less drive to win and admit greater nervousness and greater feelings of inadequacy. The attitudes of the normal control group varied, at one point being similar to those of the aggressive boys and at another appearing to have more in common with the submissive group.

AUTHOR'S SUMMARY.

A Long-Term Study of Children: The Cambridge-Somerville Youth Study. P. S. deQ. Cabot, Child Development **11**:143 (June) 1940.

This paper gives a description of the objectives, origin, philosophy and methodologic procedures of a privately endowed organization. The chief aim of the Cambridge-Somerville Youth Study is to prevent delinquency and to measure the results of the efforts in this direction during a ten-year period beginning June 1, 1939. Boys 6 to 12 years of age were referred by public and parochial schools, courts and social agencies. Pertinent data about the social, developmental, physical and mental characteristics of each boy were collected from the parents, the teachers and the representatives of the agencies. From the 1,866 boys referred, 782 were selected, of whom some were average in behavior but the majority were difficult or predelinquent. The 325 boys belonging to a treatment group were carefully matched with a like number in a control group. Counselors carry out the treatment program, and information is obtained on the control boys from all available sources. A summary of treatment services from 1939 is given. The staff organization is described, with a listing of the members of two advisory committees, and the characteristic features of the program are summarized.

Author's Summary.

Fels Mental Age Values for Gesell Schedules. Virginia Nelson and T. W. Richards, Child Development **11**:153, 1940.

In order to get mental age values for the Gesell schedules at the ages of 6, 12, 18 and 24 months the variability in these scores (number of items passed) in the Merrill-Palmer scores at 24, 30, 42, 48 and 54, and in mental ages for the Stanford-Binet scale at 36, 48 and 60 were calculated. These distributions represented substantially the same children at each age level. It was found that the mean and the sigma of mental age for the Merrill-Palmer and Stanford-Binet scales tended consistently to be such as to give an intelligence quotient of about 115 with a sigma of about 15 intelligence quotient points.

It was assumed that the mean and the variability in mental performance during the 6, 12, 18 and 24 month age levels were similar to what they were at the later age levels and that the Gesell schedules measured this performance. The mean Gesell score at each age level was equated to that mental age which would give an intelligence quotient of 115, and the sigma in Gesell score was equated to that difference from the mean in mental age which would give an intelligence quotient difference from the mean of 15 intelligence quotient points.

Tables are presented showing mental age values for each raw Gesell score calculated from these inferred means and sigmas.

Authors' Summary.

Diseases of the Genitourinary Tract

A Case of Urinary Calculi in an Infant. Raymonde Chapelo, Bull. Soc. pédiat. de Paris **37**:394 (July) 1939.

An undernourished boy had an infection of the upper respiratory tract and a digestive upset. He was found to have a stone in the left renal pelvis after some calculi had apparently descended into the bladder and were passed. Prior to this it was thought he might be suffering from intussusception or volvulus. Two types of calculi are discussed: (1) those containing uric and oxalic acids, in the production of which metabolic disturbances, diet, dehydration and diathesis are believed to be etiologic factors, and (2) alkaline stones consisting of phosphates and carbonates which develop as a result of infection. It is said that fewer infants with urinary calculi are encountered in France than in England or oriental countries. The incidence of calculus formation is considered to be about equal in the two

sexes, and the greater frequency of vesical calculi in boys is probably due to the fact that they are more easily passed through the urethra in the female than in the male.

BENJAMIN, Montreal, Canada.

A CASE OF TRANSIENT LEVULOSURIA. JULIEN HUBER, J.-A. LIÈVRE, P. LAJOUANINE and P. MEUNIER, Bull. Soc. pédiat. de Paris **37**:436 (July) 1939.

A girl, 8 years old, had an infection of the throat ten days after tonsillectomy. Her urine contained 5 Gm. of levulose per liter on the day of admission to the hospital. Investigation of sugar tolerance showed no evidence of diabetes. No levulose or dextrose was demonstrated in the urine after large amounts had been ingested. The occurrence of levulosuria in this instance is of no unfavorable prognostic significance, while it would be of serious import in a case of diabetes.

BENJAMIN, Montreal, Canada.

A CASE OF NANISM AND RENAL RICKETS. H. GRENET, GAUTHERON and SAULNIER, Bull. Soc. pédiat. de Paris **37**:470 (Jan.) 1940.

A 14 year old girl who had been small since birth showed dwarfism. There was genu valgum. Roentgenograms of the long bones revealed abnormalities resembling rachitic lesions. Renal function was impaired. In retrograde pyelograms both ureters appeared to be dilated, the pelves were poorly developed and the right inferior calix was absent. The levels of calcium and phosphorus in the blood were low.

BENJAMIN, Montreal, Canada.

RENAL INSUFFICIENCY AND ABNORMALITY OF THE NECK OF THE BLADDER TREATED BY ELECTROCOAGULATION: LATE RESULTS. H. ROUÈCHE, Bull. Soc. pédiat. de Paris **37**:474 (Jan.) 1940.

A boy who had been operated on for obstruction of the neck of the bladder was reexamined fifteen months later. The retention of urine had disappeared, but pyuria and impaired renal function persisted, probably because of the renal malformation.

BENJAMIN, Montreal, Canada.

BILATERAL NEPHROTOMY FOR RENAL CALCULI FOLLOWED BY MUSCULAR ATROPHY. NAGEOTTE-WILBOUCHEWITCH, Bull. Soc. pédiat. de Paris **37**:476 (July) 1939.

A 12 year old girl had two large calculi removed from each kidney. Bilateral nephrotomy was performed, with an interval of seven days between the two operations. When examined two months later she showed weakness and atrophy of the muscles of the lower extremities. There were no sensory disturbances. With treatment by exercises the condition gradually improved, and she was well one year later.

BENJAMIN, Montreal, Canada.

Diseases of the Ductless Glands; Endocrinology

CHORIONIC GONADOTROPIC EFFECTS ON HEIGHT AND OSSEOUS DEVELOPMENT IN SEXUALLY UNDER-DEVELOPED YOUNG BOYS. GEORGE B. DORFF, Endocrinology **27**:403 (Sept.) 1940.

Nine sexually underdeveloped boys less than 8 years old were studied for the effects of chorionic gonadotropin on both height and ossification during the course of treatment and after it had been terminated for a number of years.

Five of 9 patients who were moderately tall and 1 who was originally stunted showed a marked spurt in height.

There was little or no acceleration of growth in height in the very tall boys (only 3 of 9 showed such change). They simply maintained their original high height curves throughout the period of observation.

Osseous development was accelerated in all cases but 1, regardless of whether the osseous development originally was retarded, normal or advanced.

It is likely that the gonads, stimulated by gonadotropin, will in turn stimulate the production of the growth-stimulating factor of the anterior lobe of the pituitary.

Evidence is lacking, even many years after treatment has been terminated, of premature epiphysial closure in any of the young boys even though some showed a marked acceleration of growth in height and of osseous development.

JACOBSEN, Buffalo.

CRETINISM. E. KOST SHELTON, B. N. TAGER and ELIZABETH HOYT, Endocrinology **27**:425 (Sept.) 1940.

This is a report on a cretin girl who was studied over a period of four and one-half years during controlled intervals of therapy with (*a*) an alkaline extract of the anterior lobe of the pituitary, (*b*) thyroid and (*c*) thyroid plus vitamin B complex.

An increase of 13.3 inches (34 cm.) in height was attained in three years, which is equivalent to about 190 per cent of the normal or 700 per cent of the previously observed rate of growth without thyroid treatment. The bone age advanced approximately nine years during this period.

Criteria furnishing a guide to the possible mental development obtainable by a cretin are discussed.

JACOBSEN, Buffalo.

A NEW CONCEPTION OF PARATHYROID FUNCTION AND ITS CLINICAL APPLICATION: A PRELIMINARY REPORT ON THE RESULTS OF TREATMENT OF GENERALIZED FIBROCYSTIC AND ALLIED BONE DISEASES AND OF RHEUMATOID ARTHRITIS BY ALUMINUM ACETATE. A. J. HELFET, Brit. J. Surg. **27**:651 (April) 1940.

The author suggests the following theory: The secretion of the parathyroids controls the level of inorganic phosphate in the blood, and any accumulation of phosphate in the blood is a stimulus to increased secretion of the parathyroids. The parathyroids effect control by stimulating the kidney to excrete phosphate and by mobilizing calcium ions from the bones. From these is formed calcium phosphate, which is inactive and can be kept in solution in the blood in greater than normal quantities and in a form which can be excreted.

It is suggested that in hypoparathyroidism possibly either the low level of calcium or the high level of phoshorus in the serum may be responsible for the actual manifestations of tetany. The author points out that in a number of cases of infantile tetany there is a raised level of phosphorus with a normal level of calcium in the serum. The author reviews the symptomatology of hyperparathyroidism and refers to the various types of the disease. He offers the following classification, which is based partially on the chemical characteristics of the blood.

1. Primary hyperparathyroidism is due to adenoma and is typically characterized by generalized fibrocystic disease with a raised level of calcium and a lowered level of phosphorus in the blood.

2. Secondary hyperparathyroidism is of two types. (*a*) In the simple compensatory or physiologic type the picture resembles that of a mild form of primary hyperparathyroidism, but the levels of calcium and phosphorus in the blood are normal. The parathyroid tissue is normal or shows only general hyperplastic changes. In the pathologic type, in which an adenoma is superimposed on the simple compensatory type, the disease is clinically similar to the primary type but reverts to the simple compensatory type after removal of the adenoma.

In accordance with the author's theory, an attempt was made to treat patients with various types of the disease by reducing the intake of phosphorus. The dietary method was discarded as impracticable. Instead, use was made of aluminum acetate, which combines with the phosphate in the intestine to form insoluble aluminum phosphate, which is then excreted in the feces. The author noted

improvement in his cases of secondary fibrocystic disease and of Paget's disease. Notable improvement was also apparent in a few cases of rheumatoid arthritis.

KEITH, Toronto, Canada.

STUDIES ON MECHANISM OF INSULIN CONVULSIONS: EFFECTS OF VARYING PARTIAL PRESSURES OF ATMOSPHERIC OXYGEN AND CARBON DIOXIDE IN ADRENALECTOMIZED ANIMALS. I. MCQUARRIE, M. R. ZIEGLER, W. E. STONE, O. H. WANGENSTEEN and C. DENNIS, Chinese M. J. **58**:26 (July) 1940.

This contribution to the discussion on the mechanism of insulin convulsions is published in the same number of the journal which contains the report on the first part of these experiments. This group, however, used adrenalectomized instead of normal dogs. Both contributions come from the department of pediatrics of the University of Minnesota and the division of pediatrics of the Peiping Union Medical College (China).

It was found that when fasting adrenalectomized dogs breathed an atmosphere composed of 5 to 9 per cent oxygen and 95 to 91 per cent nitrogen for several hours a significant diminution in blood sugar was produced. This is the opposite of what occurred in the normal animal, in which hyperglycemia was produced under similar conditions. As the result of the hypoxemia, there was a reduction in the levels of potassium and inorganic phosphorus and in the carbon dioxide tension of the plasma. There was less increase in the blood sugar with breathing of an atmosphere consisting of 15 per cent carbon dioxide, 20 per cent oxygen and 65 per cent nitrogen than occurred in the normal animal, but the level of inorganic phosphorus and the carbon dioxide content of the plasma rose significantly. No change was produced in the level of potassium in the serum from the breathing of an atmosphere high in carbon dioxide.

The authors state that it is clearly shown that an atmosphere with a low oxygen content, a high carbon dioxide content or both has an inhibiting effect on insulin convulsions in adrenalectomized dogs.

NEFF, Kansas City, Mo.

Diseases of the Muscles, Bones, Joints and Lymph Glands

PALATAL MYOCLONUS IN AN OTHERWISE NORMAL BOY. E. L. MURPHY and A. P. FAGAN, Irish J. M. Sc., September 1940, p. 675.

Palatal myoclonus in an 8 year old boy is described. The myoclonus ceased on deep expiration and inspiration. It was made more evident by compression of the nares. There was no other evidence of disease of the central nervous system.

SNELLING, Toronto, Canada.

CONGENITAL LACUNAS OF THE CRANIAL VAULT: HEREDITARY AND FAMILIAL CHARACTER OF THIS MALFORMATION. R.-A. MARQUÉZY, LADET, DI MATTEO and B. HACKER, Bull. Soc. pédiat. de Paris **37**:377 (July) 1939.

A girl, 22 months old, had two large lacunas of the cranial vault. Her mother and 2 brothers had similar cranial anomalies. The first child, now 12 years old, was mentally retarded. Her father was the mother's first husband, while the father of the other 2 children was the second husband.

BENJAMIN, Montreal, Canada.

ASSOCIATED MYOPATHY AND FRIEDREICH'S DISEASE. H. GRENET, GAUTHERON and SAULNIER, Bull. Soc. pédiat. de Paris **37**:466 (Jan.) 1940.

A boy, 8½ years old, had difficulty in walking and ataxia for several years. He showed marked weakness and atrophy of the extremities, especially at their proximal parts, as well as the typical features of Friedreich's ataxia. There was no family history of neurologic disease.

BENJAMIN, Montreal, Canada.

Diseases of the Eye

THE CROSS-EYED CHILD—SOME IMPORTANT CONSIDERATIONS. LLOYD H. BERRIE, J. Maine M. A. **31**:325 (Dec.) 1940.

In discussing the case of the cross-eyed child, the author emphasizes the following:

1. The cross-eyed child has a tremendous psychologic, as well as physical, handicap.

2. If such a child is brought under competent early care (at the age of 1 to 7 years) much can be done without resorting to surgical measures.

3. To delay early treatment is to encourage unilateral blindness.

4. The age at which surgical intervention should be undertaken must be determined by diligent study of each individual patient. WEIGAND, Indianapolis.

DISLOCATION OF THE LENS, WITH OTHER CONGENITAL DEFECTS: SECONDARY GLAUCOMA. N. B. HARMAN and R. BUXTON, Brit. J. Ophth. **24**:135 (March) 1940.

A child with dislocation of the lens and other congenital defects had normal parents. At the age of 5 years myopia of 18 D. was corrected. Both feet showed metatarsus varus of severe degree. The child's physique was poor and his posture bad. At 11 years of age it was definitely determined that the lenses were dislocated. At a somewhat later period vision in the right eye with a —25 D. sphere was 6/36, and in the left eye with a —22 D. sphere it was 6/18 (partly).

Still later, as the aphakic gap had increased, he was given a +11 D. sphere. With this glass vision in the right eye was 6/18 and in the left eye 6/24. At the age of 19 acute glaucoma developed in the right eye. The lens was removed in its capsule, and the prolapse of the vitreous was controlled by a corneoscleral suture. The resulting vision was 6/18. W. ZENTMAYER. [ARCH. OPHTH.]

OPTIC NEUROMYELITIS IN A CHILD OF TWO YEARS. S. GRACOSKI and TITUS MĂRCULESCU, Bull. Soc. de pédiat. de Iasi **8**:55 (Jan.-June) 1937.

Previous descriptions of optic neuromyelitis have been confined to the cases of adults and adolescents. The case presented is thought to be the first reported of a young child. The child was normal until the age of 1½ years. At that time, after an acute febrile infectious disturbance, which resembled malaria and for which quinine was given, he manifested paraplegia, which was flaccid at first and accompanied by disturbances of the sphincters, and later developed into a spastic type, with disappearance of the sphincter involvement. At the beginning there was strabismus, but later blindness developed. The hearing and the emotional response seemed to be normal. Examination of the cerebrospinal fluid showed 14 cells per cubic millimeter and a slight increase in albumin. Ophthalmoscopic examination showed beginning atrophy of the optic nerve and no edema. The similarity of the disease in this case to multiple sclerosis and its differences from that disorder are discussed. LESLIE, Evanston, Ill.

Skin Diseases; Allergy

STUDIES IN ABSORPTION OF UNDIGESTED PROTEIN IN HUMAN BEINGS: VIII. ABSORPTION FROM THE RECTUM AND A COMPARATIVE STUDY OF ABSORPTION FOLLOWING ORAL, DUODENAL, AND RECTAL ADMINISTRATION. IRVING GRAY and MATTHEW WALZER, J. Allergy **11**:245 (March) 1940.

The study was conducted on men and women varying in age from 21 to 62 years who suffered from various organic and functional disturbances of the gastro-

intestinal tract. They were divided into three groups according to the degree of gastric acidity, that is, their showing on the basis of hypoacidity, normal acidity or hyperacidity.

Ten grams of ground raw peanuts in 20 cc. of water was introduced by tube into the rectum.

The authors' conclusions are: The absorption of unaltered peanut antigen, which was previously shown to follow oral and intraduodenal administration, is now demonstrated to follow rectal administration; the average absorption rate after rectal administration of the peanut antigen approximates that following intraduodenal introduction and is more rapid than that after oral ingestion; in patients with gastric hyperacidity the absorption of peanut antigen from the rectum is slightly retarded, an observation which was also made after the oral and the intraduodenal administration of the antigen to such patients. HOYER, Cincinnati.

ORAL VS. PARENTERAL POLLEN THERAPY. A CLINICAL STUDY. BERNARD P. ALPERSTEIN, J. Allergy **11**:498 (July) 1940.

This is a chronologic review of the subject, which reveals no unanimity of method, no standardization of dosage and no control for comparison. The purpose of this study was to evaluate the clinical, or therapeutic, effects of the oral method of giving pollen therapy as compared with those of the parenteral mode of administration. The results for a control group are included. The author's conclusions are:

"1. The oral method of pollen therapy gave satisfactory clinical relief in ragweed-sensitive patients who had not been treated in prior seasons; those who had had the parenteral form of therapy in previous seasons benefited much more from the oral form than those who had never been treated before.

"2. Neither the site of allergic manifestations nor the degree of sensitivity bore any relation to clinical relief of symptoms under any mode of treatment.

"3. Unpredictable reactions occurred with the oral method. The range of dosage (by the oral method) within which reactions occurred was quite wide, anywhere from 1,000 to 90,000 Noon units. The reactions were of three types, gastrointestinal, respiratory, and systemic.

"4. The parenteral method gave a greater percentage of satisfactory relief as well as a smaller percentage of complete failures than did the oral method.

"5. In view of the unpredictable reactions, a rigid schedule for oral pollen therapy cannot be planned for self-administration by patients. It is thus inadvisable to allow patients to treat themselves by the oral method.

"6. The plan of therapy for the subcutaneous administration of pollen extracts is amenable to individual needs and flexible enough to serve as a guide to obtain optimum results with maximum dosage.

"7. The experiments with the blood and urine of patients treated orally show that (a) an appreciable amount of pollen is absorbed through the gastrointestinal tract; and (b) that reagin and allergen coexist in the circulating blood at the same time at the height of treatment.

"8. The oral method is not recommended inasmuch as it has no particular advantage over the parenteral method; nor do the results obtained (by the oral method) show nearly as much beneficial clinical relief as those obtained by the parenteral method." HOYER, Cincinnati.

ELECTROLYTE AND WATER EXCHANGE IN BRONCHIAL ASTHMA, WITH EMPHASIS ON THE INFLUENCE OF PITRESSIN. A. V. STOESSER and M. M. COOK, J. Allergy **11**:557 (Sept.) 1940.

A group of 6 children with bronchial asthma were studied in an attempt to determine the relation of water loss and a low salt content of the diet to the improvement seen in patients with asthma placed on a low salt diet.

Administration of pitressin causes water retention even when the diet is low in salt. Opportunity was taken of this phenomenon in this study. The children were placed on a low salt, acid ash diet; after a while pitressin was administered and additional water was added to the diet, with a subsequent gain in weight and improvement of symptoms. Administration of pitressin was then discontinued, and this was followed by diuresis. The relief of symptoms continued, however, until salt was added to the diet, which indicates that perhaps the electrolyte exchange was responsible for the clinical improvement.

The authors feel that no positive conclusions regarding therapy are warranted at this time and that the results are of more value as a basis for further investigation.

HOYER, Cincinnati.

ANNUAL REVIEW: ALLERGIC DISEASES IN CHILDHOOD. WILLIAM C. DEAMER, J. Allergy **11**:609 (Sept.) 1940.

This is a good critical review of the literature pertaining to allergic diseases in childhood. Several items of interest are mentioned, some of which are new and others old.

One of the old subjects is the question of the decision to be made in regard to tonsillectomy and adenoidectomy. A number of papers were devoted to this subject, indicating that the possibility of allergy must be thought of before a decision is made. Several papers were devoted to headache in children, and the authors were of the opinion that it occurred more frequently than is generally thought and may have an allergic basis. The differences in thought with regard to the use of heated milk in the treatment of eczema still continue. A number of papers were devoted to the question of the use of vitamins in the therapy of allergy, especially vitamin C. Some workers believe that it may have a place in the prevention of some allergic manifestations, while others feel that it has little or no value. Several instances of sensitivity to ascorbic acid tablets have been reported.

HOYER, Cincinnati.

THE QUESTION OF CONGENITAL TRANSMISSION OF LYMPHOGRANULOMA VENEREUM. N. MELCZER and K. SIPOS, Dermatologica **81**:163 (March) 1940.

The authors report the case of a 39 year old woman with genitoanorectal elephantiasis due to lymphogranuloma venereum. Already suffering from this disease, she had given birth to a girl, who at the age of 3 years had repeatedly positive reactions to Frei tests but no signs of a past or present infection with lymphogranuloma venereum. This allergy of the child was regarded as the result of a healed infection. Five months later five tests with different human Frei antigens gave repeatedly negative results. Retrospectively, the previous positive results of the tests were considered nonspecific.

CURTH, New York. [ARCH. DERMAT. & SYPH.]

THALLIUM POISONING. H. STEIDLE, Med. Welt **13**:1557, 1939.

Thallium seems to have assumed to some extent the toxicologic role of arsenic. After one or two days there usually develops polyneuritis, with severe pains chiefly in the soles, calves and knee joints. The patient complains of a furry feeling, formication and hypersensitivity to touch. During the third or fourth week loss of hair sets in, which may lead to complete baldness. General weakness and loss of weight are frequent. The onset of thallium poisoning is sometimes accompanied by vomiting, diarrhea and intestinal colic and later by constipation. There is an increase in eosinophils, particularly lymphocytes. The urine may contain protein, granulated casts and erythrocytes. The finger nails may show transverse streaks similar to those occurring in arsenic poisoning. Impairment of vision and even complete blindness may occur. In obscure forensic cases it should be a rule to

search not only for arsenic but for thallium. Thallium can be found in the urine for weeks or months. In the body it is found in the blood and, especially, in the liver, the kidneys and the skeletal musculature. In cadavers it can be detected after years. Among the methods of demonstration, the spectroscopic examination is of the greatest importance. It permits the detection of thallium salts if they amount to only 1 part in 100,000. If 1 drop of a solution which contains from 0.02 to 0.03 microgram of thallium is evaporated in a platinum loop, which is then brought into the nonluminant flame, the characteristic light green line can be seen at 5,350.48.

[ARCH. PATH.]

POSTURAL CORRECTION IN CHILDREN: AN ANALYSIS OF FORTY-EIGHT PATIENTS. LEWIS COZEN, Arch. Pediat. **57**:287 (May) 1940.

Forty-eight children were treated for malposture over a period of six months. Therapy consisted of instructing both parent and child about the correct anatomic and functional poise needed in the particular case. Exercises were performed at the clinic weekly or biweekly and daily at home. No fixed list of exercises was used, since each child was treated as an individual problem. A list of some of the exercises is submitted. A questionnaire was answered by the parents in order to evaluate the results. In conclusion, the author states that it is possible to assure parents that they will probably note an improvement in the well-being of their children with this type of treatment.

ORR, Buffalo.

ANESTHESIA IN NORMAL LABOR. J. DIRCEU DE ANDRADE, Rev. de gynec. e d'obst. **34**:313 (Nov.) 1940.

This report is a résumé of six years of work devoted by the author to this problem during which he has experimented with induction of anesthesia by various methods, including the use of gases, administration of barbiturates, production of twilight sleep and use of local infiltrations of both the vulvar and the visceral metameric areas. He concludes that even though painless childbirth is as yet unattainable, at least in a considerable proportion of cases alleviation of pain is possible, especially by the use of the Gwathmey method, the results of which have proved highly beneficial not only to the mother but to the child. He believes that a thorough study should be made of analgesics, since many of them even if harmless to the mother are injurious to the child.

SOTO, Habana, Cuba.

Society Transactions

NEW YORK ACADEMY OF MEDICINE, SECTION OF PEDIATRICS

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Regular Meeting, May 8, 1941

Congenital Diaphragmatic Hernia with Operation at the Age of Twelve Weeks. DR. WILLIAM G. HEEKS.

V. D., aged 12 weeks, was admitted to the hospital March 4, 1941, a diagnosis of left diaphragmatic hernia having been made at another hospital two weeks before. The only complaint was that at times the baby got slightly blue around the mouth when fed.

Physical examination showed that abnormalities were limited to the chest. The thorax was symmetric. The heart was displaced to the right, both to percussion and to auscultation. There was slight hyperresonance over the lower part of the left side of the chest anteriorly, and the breath sounds were diminished in this area.

Roentgen examination revealed that the heart and the mediastinum were displaced to the right and the right lung was emphysematous. There was a marked irregularity in density in the lower half of the left side of the chest with several large shadows typical of gas-filled intestines. The observations were typical of left diaphragmatic hernia.

The physical condition was good, and on the third day in the hospital, with the use of local anesthesia, the left phrenic nerve was isolated in the neck. On the following day the abdomen was opened through a left subcostal incision. Half the stomach, the transverse colon and the splenic flexure, several loops of small intestine and the spleen were found in the left pleural cavity. There was a large defect in the diaphragm corresponding to the foramen of Bochdalek. The medial portion of the ring was completely hidden by the left lobe of the liver, which was partially rotated into the thoracic cavity. The viscera were restored to their normal positions in the abdominal cavity. At this point the phrenic nerve was crushed with a hemostat at the site of previous isolation, and the margins of the diaphragmatic defect then immediately came into apposition. The margins were approximated with interrupted mattress suture of silk and a firm closure obtained. The abdominal wall was closed in layers with silk.

The infant was returned to the ward in good condition and was placed in an oxygen tent, where he was kept for three days. Slight distention on the second day was quickly relieved with a Levine tube. The temperature rose to 101 F. on two days and then remained normal. Feedings were taken well, and the bowels moved normally. His convalescence was entirely uneventful, and he was discharged twenty-one days after admission, at which time the left lung was well expanded; there was no pleural effusion, but the heart was still displaced to the right.

DISCUSSION

Little attention has been paid in the literature to diaphragmatic hernia in the newborn in spite of the fact that operative treatment offers such excellent results. Ladd estimated that 75 per cent of the infants with this abnormality will die if no therapeutic measures are instituted. I know of 2 fatalities from intestinal obstruction which developed before operation could be performed.

Congenital diaphragmatic hernia results from failure of fusion in various parts of the embryonic diaphragm. The commonest sites of the defect are: (1) at the foramen of Bochdalek, resulting from failure of closure of the pleuroperitoneal hiatus; (2) at the foramen of Morgagni, resulting from failure of fusion of the sternal and costal fibers on either side of the sternum; (3) at the esophageal hiatus, and (4) in the dome of the diaphragm.

Diagnosis is not difficult, and the condition should be excluded in the case of an infant with dyspnea, cyanosis, cough, vomiting or signs of intestinal obstruction. Roentgen examination affords an opportunity to establish the diagnosis.

There are certain details of value in treating this condition which I wish to offer for consideration, making no claim for originality in any of them. Isolation of the phrenic nerve as a preliminary procedure is invaluable. It is readily done with the use of local anesthesia, and the nerve can then readily be crushed, for the purpose of paralyzing the affected side of the diaphragm, at the time of the major procedure. If this is not done it may be impossible to close the defect. The crushed nerve regenerates in a relatively short time.

Operation is best performed with the patient under positive pressure anesthesia whenever possible. I believe the abdominal approach is the most satisfactory. Removal of the viscera from the chest is often aided by inserting a soft rubber tube through the defect so that air may be gently blown in to overcome the negative pressure in the chest, which tends to hold the viscera. Frequently the abdomen is not sufficiently developed to accommodate the viscera after reduction. In such a case Ladd has advocated undercutting the skin margins widely and effecting closure by skin suture only. After a week or ten days sufficient stretching will have occurred to allow proper closure of the abdominal wall.

All details of the postoperative care are, of course, essential, and the use of an oxygen tent is of value. If pleural effusion develops the fluid should be aspirated.

Finally, operation should be done early, usually as soon as the diagnosis is made.

Possible Intermittent Hydrarthrosis. DR. MARTIN GREEN.

A 6½ year old white girl first showed swellings on the dorsal side of both wrists at the age of 1½ years, when she also had a series of colds accompanied by sore throat, cough and fever. By the age of 4 years she had persistent effusions of the joints, especially of the knees and wrists; the size of the effusions varied from time to time. She was then placed in a convalescent home, where she remained for a prolonged period.

Four days before admission the child complained of slight pain in the left knee, and both knees were swollen. On admission examination showed slight pharyngitis and a harsh systolic murmur over the entire precordium, loudest at the third left interspace along the sternum. There was a large accumulation of fluid in both knees, extending for about 10 cm. over the lower part of the femur. There were smaller accumulations of fluid at the ankles, wrists and elbows. The laboratory data were entirely normal except for a slightly elevated sedimentation rate, which became normal in two weeks. The blood count was essentially normal. Roentgenograms of the knees showed slight distention of the joint capsule and slight soft tissue swelling. The teleroentgenogram of the heart suggested a slight valvular lesion, while the orthodiagram showed a normal-sized heart.

The synovial fluid showed 622 leukocytes per cubic centimeter, with 84 per cent lymphocytes and 16 per cent polymorphonuclears. The total protein content of the synovial fluid was 1.2 Gm. per hundred cubic centimeters.

During hospitalization the joints became somewhat smaller; the heart murmur changed in character, becoming more intense and more widespread.

The condition in this case is probably atrophic arthritis (Still's disease); also to be considered are atypical rheumatic fever involving the joints, intermittent hydrarthrosis or low grade chronic infectious arthritis.

Trichinosis Simulating Poliomyelitis. Dr. Agnes G. Wilson.

An 11 year old Negro boy was admitted to Willard Parker Hospital in May 1940 with a tentative diagnosis of acute anterior poliomyelitis. The illness had begun four days before admission with headache, which had persisted to the time of admission. On the day before admission fever, weakness of the right leg and later pain in the arms, legs and back and nuchal rigidity developed. The disease was rapidly progressive, and on the day of admission there were total paralysis of the legs and partial paralysis of the arms.

On admission his temperature was 103.4 F., and the pulse rate was 120 per minute. He was acutely though not critically ill and was well orientated, but he was in severe pain and showed apprehension when any attempt was made to approach him, screaming whenever moved. There were marked hyperesthesia of the arms, legs, neck and back, muscle tenderness and moderate rigidity of the neck. There was no voluntary movement of the extremities, although some strength remained in the muscles of the arms. All of the deep reflexes were absent, and the superficial reflexes were hypoactive. No pathologic reflexes were elicited. The cranial nerves were normal.

The cerebrospinal fluid both on admission and four days later was normal.

The fever continued, gradually diminishing, for ten days after admission. During this period he continued in acute distress but no new signs or symptoms developed. Twelve days after the onset of the illness he no longer screamed when moved, and from this time there was a continuous return of muscle strength, so that by two and a half weeks after onset he moved easily. By the time of discharge, six weeks after onset, there was a complete return of muscle function, but the deep reflexes though present were still diminished.

Obtaining normal cerebrospinal fluid on the fifth day of the illness made the diagnosis of poliomyelitis less probable. The leukocyte count of 9,000 with 9 per cent eosinophils, obtained on admission, suggested trichinosis. Strong corroborative evidence was the patient's response to questioning about the ingestion of pork. Although he was in acute pain he smiled and said that a 14 year old brother often cooked pork chops for their dinner; the last pork was eaten forty-eight hours before the onset of headache. The third day after admission the leukocyte count was 10,000, with 25 per cent eosinophils, and one month later it was 7,000, with 24 per cent eosinophils.

The reaction to a cutaneous test with trichinella antigen (1 : 10,000 dilution) was negative on the fifteenth day of the illness but positive on the thirtieth day. The precipitin test gave positive results on the fifteenth day. (The reaction to the cutaneous test usually becomes positive from two to four weeks after infection, but the result of the precipitin test is seldom positive before the thirtieth day.)

Examination of the blood for trichina larvae gave negative results; the cerebrospinal fluid was not examined for larvae. A biopsy of the deltoid muscle five weeks after onset showed encysted trichinas and subacute myositis.

Many cases of trichinosis in which there was involvement of the central nervous system have been reported. The pathologic changes consist of inflammatory nodules about trichina larvae and areas of destruction thought to be due to toxin. No satisfactory explanation of the mechanism of the production of muscle weakness and absent tendon reflexes has been offered. The prognosis is good when muscle weakness and reflex changes alone are present but more serious when there are mental symptoms and evidence of local lesions of the central nervous system.

Reaching a diagnosis early in this case was difficult because there was no history of disturbance of the gastrointesfinal tract, edema of the eyelids or conjunctivitis and the predominating neurologic picture so closely resembled that of acute anterior poliomyelitis.

Cerebral Embolism Complicating Rheumatic Fever. Dr. Edward Press, Brooklyn.

L. I., a 12½ year old white girl, was admitted to the hospital because of intermittent joint pains, fever and chills of two months' duration. Suspicion of heart disease was first aroused nine months prior to admission, when a routine examination for entrance to a summer camp disclosed a heart murmur. There was no history of any condition such as chorea, scarlet fever or joint pains. For five or six months prior to admission there was occasional transient precordial pain on exertion, but there had been no other symptoms of rheumatic fever until two months prior to admission, when there was a gradual onset of bouts of pain and tenderness in the small joints associated occasionally with fever and chills. Her past history was irrelevant. The mother has rheumatic heart disease.

Physical examination revealed a poorly nourished, pale child in no acute distress and with moderate fever. Enlargement of the heart with a double mitral murmur was present, but there was no evidence of congestive failure. The left ankle was tender and swollen. No clubbing of the fingers, petechiae or subcutaneous nodules were present.

Laboratory examinations revealed secondary anemia with a hemoglobin content of 50 per cent. The Wassermann reaction of the blood was negative; the erythrocyte sedimentation rate was 6 mm. in one hour on admission, but three or four days later it was 68 mm. in one hour. A roentgenogram showed signs of pulmonary congestion, and the electrocardiogram showed a slightly prolonged auriculoventricular conduction time and a slurring of the QRS complex in lead III.

The course was typical of active rheumatic fever, with low grade fever and occasional joint pains for the first few weeks. On the twenty-fourth day in the hospital the patient was found semiconscious, with spastic right hemiplegia. The heart rhythm remained regular at all times, and in the days that followed there was a progressive, gradual return of function of the involved muscles, which never became complete. Repeated blood cultures before and after the episode were sterile. Laboratory and clinical evidence of active rheumatic fever, including joint pains, changes in the auriculoventricular conduction time and elevation of the sedimentation rate, persisted for two or three months; so the patient was not discharged until four months after admission. On discharge there was only slight to moderate weakness of the extremities on the right, chiefly in the arm. Examination of the heart showed enlargement and a double mitral lesion.

Follow-up examination revealed no change in the cardiac status, but improvement of the paresis had progressed until there remained only weakness of the extensors of the hand and absence of associated swinging movements of the right extremity on walking.

DISCUSSION

The rarity of cerebral embolism as a complication in the case of children with rheumatic fever who have a regular cardiac rhythm and no bacterial endocarditis is briefly discussed, and a simple mechanism for its causation is advanced.

Bleeding Due to Prothrombin Deficiency During Gastrointestinal Intoxication. Dr. Martin J. Glynn.

Hypoprothrombinemia may be expected to occur in various diarrheal states. This follows from the nature of the four factors which, broadly speaking, affect the level of prothrombin in the plasma. These are the amount of vitamin K in the diet, the absorption of vitamin K, the internal metabolism of prothrombin and the amount of vitamin K and prothrombin present at birth. The literature contains little information about hypoprothrombinemia during diarrhea in infants.

Confirmation of the theory that hypoprothrombinemia is to be expected to occur during diarrhea is afforded by the following case. An 11 day old white

boy was hospitalized because of vomiting of seven days' duration. During hospitalization severe diarrhea developed, for which he was starved. On the fifth day of starvation he began to bleed excessively from the sites of venipuncture, and an ecchymosis developed. The prothrombin level was 9 per cent of that of a normal adult. After 1 mg. of menadione (2-methyl-1, 4-naphthoquinone) was given intramuscularly the prothrombin level rose to 20 per cent and the prolonged bleeding ceased. After one week, during which the caloric intake was low, bleeding recurred; it ceased after the administration of menadione in peanut oil (klotogen).

Two other infants with severe diarrhea who were subjected to four days of starvation and bled excessively following venipuncture showed a good response to the administration of vitamin K.

These cases indicate that abnormal bleeding during the course of diarrhea is in some instances due to hypoprothrombinemia. They suggest that vitamin K may be a useful agent when such bleeding occurs. They further suggest that in the cases of young infants with severe diarrhea who require several days' starvation the administration of vitamin K as a prophylactic measure may be warranted.

Meconium Ileus. DR. BERNARD S. DENZER.

A normal full term baby, 2 days old, was admitted to the hospital with a history of abdominal distention, vomiting of bile-stained material and absence of flatus and meconium since birth. A roentgenogram confirmed the clinical impression of intestinal obstruction. Operation was performed immediately. The jejunum was contracted; the proximal loops of the ileum were greatly dilated, and the dilatation tapered off in a conelike fashion to the ileocecal junction. Ileostomy was performed and a tube inserted into the ileum. The following day thick, putty-like meconium was aspirated, and the suggestion of meconium ileus was made. The child died.

Autopsy showed contraction of the colon and funnel-shaped dilatation of the distal 2 or 3 feet (61 or 91 cm.) of the small intestine. This portion of intestine contained thick, greenish, putty-like meconium, which could be scraped from the intestine only with difficulty. There was no other intrinsic or extrinsic obstruction. The liver was normal, as were the hepatic and cystic ducts. Grossly the pancreas was also normal. On section it showed moderate dilatation of the ducts within the head and a mild degree of interaciner fibrosis. Neither of these two processes was as striking in degree as the conditions reported by Dodd in 1936 and Kornblith and Otani in 1929.

The question arises whether in this case the fibrocystic change was sufficiently severe to explain the occurrence of meconium ileus. The severity of the disturbance may be out of all proportion to the degree of demonstrable organic change; furthermore, the secretory dysfunction may have persisted since early uterine life (fourth month of gestation), and the inspissation and obstruction may have been cumulative. One hesitates to suggest a functional origin for so serious a condition. However, cases have been reported in which recurring symptoms of obstruction were relieved by the spontaneous extrusion of meconium plugs. In the case reported here the condition may have been due to a profound functional disturbance secondary to relatively mild fibrocystic disease of the pancreas.

Meconium Ileus. DR. IRWIN P. SOBEL.

A girl, born uneventfully and normal on physical examination began to vomit bile-stained material thirty-six hours after birth. The abdomen was then distended and showed visible peristalsis. A flat roentgenogram showed distention of the small intestine indicative of mechanical obstruction in the right lower quadrant of the abdomen. A laparotomy was performed forty-eight hours after birth. The distal 2½ foot (76 cm.) portion of ileum was greatly distended, and the colon was collapsed. Ileostomy was performed at the termination of the ileum, which was

filled with tenacious, rubbery meconium which could not be removed. Forty-eight hours later a small pus basin full of this waxlike meconium was evacuated from the upper ileostomy loop.

The postoperative course was encouraging. Normal stools were passed daily from the upper limb of the double-barreled ileostomy. On the twentieth day the child's condition began to grow rapidly worse. She began to cough and vomit. Death occurred on the twenty-third day.

Postmortem examination disclosed pneumonia of the lower lobe of the left lung with purulent exudate in the bronchial lumens. A large portion of the small intestine had herniated through a tear in the mesentery, which had been made at operation but could not be repaired then. The opening of the pancreatic duct was stenosed. Examination of the pancreas itself revealed severe cystic dilatation of the ducts and chronic cystic fibrosis. The bile ducts were normal.

Multiple Hemangiomas, with Special Reference to Hemangioma of the Spinal Cord. Dr. Stanley S. Lamm, Brooklyn.

This article will be published in full at a later date.

Cooley's Anemia; Familial Aspects of a Case in Which the Patient Was Observed from Early Childhood to Young Adult Life. Dr. Carl H. Smith.

A youth now almost 19 years old was originally observed at 4 years of age because of Cooley's (erythroblastic) anemia of moderate severity. Between the ages of 4 and 7 years he was admitted to the hospital six times because of symptoms relating to the anemia, and during three of these hospitalizations he was given transfusions. Since 1929, the time of the last hospital admission, the patient has been well and has participated in all physical activities without disability. He still has the classic roentgenographic, hematologic and physical features of Cooley's anemia. A younger brother, aged 8 years, also has Cooley's anemia of a moderately severe type.

The parents and another brother, 17 years of age, appear normal and healthy, and none of them has a palpable spleen. Examination of the blood, however, showed certain abnormalities. The smears of all 3 revealed varying numbers of red cells with basophilic stippling, and the red cells of the father and brother showed increased resistance to hemolysis in hypotonic saline solution. The red cells of the father showed a slight degree of anisocytosis and poikilocytosis. The brother's blood showed a decreased hemoglobin content and an erythrocyte count of over 6,000,000 cells per cubic millimeter. Increasing evidence indicates that the observations on the blood of these 3 apparently healthy persons characterize them as carriers of the disease.

Duodenal Ulcer with Massive Hemorrhage in a Child. Dr. Albert B. Newman.

M. R., a boy of 11 years, was admitted to the hospital in September 1940. Nine months before he had had an attack of sticking substernal pain associated with nausea and vomiting, from which he recovered in one week. Since that time there have been many recurrences of a similar nature. The child himself noted that the symptoms were relieved by meals and were especially prone to occur at night. The family history was noncontributory. On physical examination the boy appeared thin and pale. The temperature and the pulse and respiratory rates were normal. Results of the physical examination were negative except for tenderness on deep pressure in the right upper abdominal quadrant and the midepigastrium. The hemoglobin content was 80 per cent, and the red blood cells numbered 4,300,000 per cubic millimeter. The stools gave a positive reaction for blood (4 plus). Chemical examination of the blood gave normal values. Three days after admission he vomited a large amount of reddish black material

and passed a large tarry stool. The hemoglobin content dropped to 58 per cent. A presumptive diagnosis of duodenal ulcer was made, and the Sippy diet with alkaline powder was instituted. On the fifth day of his stay in the hospital the patient complained of weakness and vomited a large amount of bright red blood. The hemoglobin content dropped to 32 per cent. Treatment for shock was instituted, with continuous intravenous therapy and transfusion. The same day another profuse hematemesis with profound shock occurred. Transfusion was again performed and was repeated on the following day. The child improved gradually, and three weeks after admission a roentgenogram of the gastrointestinal tract revealed the presence of a constant deformity of the duodenal bulb characteristic of ulcer.

The patient was discharged five and a half weeks after admission in good condition and with a hemoglobin value of 86 per cent. The child remained on a bland diet with alkalis, and except for transient episodes of epigastric pain, unassociated with vomiting, he was well until four months after discharge, when the epigastric pain became very severe and vomiting of material showing a few blood streaks occurred. Physical examination at that time revealed no abnormality except tenderness over the epigastrium. The hemoglobin content was 84 per cent, and the red blood cell count was 4,900,000. Examination of the stools for blood gave negative results. A roentgenogram of the gastrointestinal tract again demonstrated the abnormality found on the previous admission. The child rapidly became free of symptoms and was discharged three and one-half weeks after admission.

Auricular Paroxysmal Tachycardia in an Infant One Month Old. Dr. Edmund N. Joyner III.

A 5 week old boy was admitted to the hospital on Jan. 12, 1941 with the complaint of a rapid heart rate. The family history was irrelevant. The pregnancy and delivery had been uneventful. The baby was examined twice during the neonatal period and once at 3 weeks of age by the attending obstetrician and found normal. The heart rate was charted as 100 and 120 per minute on the two earlier examinations. He had gained well and had seemed to thrive up to the present illness. Two days previous to admission he appeared less alert than usual and seemed rather pale. However, these symptoms were not severe enough to alarm the mother. On the night of admission he was seen because of "noisy breathing," and at this time admission to the hospital was advised because the heart rate was too rapid to count.

Examination showed a well nourished and well developed infant who appeared bright and alert but apprehensive. His weight was 8 pounds 7 ounces (3,827 Gm.), his temperature 100 F., his pulse rate too rapid to count and his respiratory rate 100 per minute, but his breathing was not labored. He was pale. The abnormalities were limited to the heart. On percussion there was no enlargement to the left, and the upper right border extended well out into the axilla, the area of dulness filling the whole upper anterior part of the right side of the chest. The heart rate was regular and above 250 per minute. The sounds were of fair quality, and no murmurs were heard. There were no signs of cardiac failure.

The Wassermann reaction was negative and the urine normal. A blood count on admission showed that the red cell count and the hemoglobin content were normal and the leukocytes numbered 24,000 per cubic millimeter, with 41 per cent polymorphonuclears, 57 per cent lymphocytes and 2 per cent mononuclears. Two days later the leukocyte and differential counts were normal. The electrocardiogram on admission showed supraventricular tachycardia, with a rate of 280 and no block. Subsequent electrocardiograms showed conditions within normal limits. Roentgenographic and fluoroscopic examinations showed tremendous enlargement of the right upper portion of the heart and a congenital deformity of the anterior leaves of the diaphragm, which were markedly elevated. Roentgen examination after a barium meal failed to show any eventration of the diaphragm.

The infant was observed for eighteen hours, at the end of which time there were signs of mild cardiac failure with enlargement of the liver and mild cyanosis. Mecholyl chloride (acetylbetamethylcholine hydrochloride) in doses of 1 and 2 mg. was given subcutaneously without appreciable effect on the heart. The following day the child was critically ill, with marked signs of congestive failure. He was placed in an oxygen tent, and digitalis in the form of the tincture was given by mouth. He received a total of 50 minims (3.08 cc.) in the first twenty-four hours. At the end of this time the rate returned to normal, and recovery was uneventful. He was given a daily maintenance dose of 10 minims (0.61 cc.) of the tincture of digitalis for three days, and then administration of the drug was stopped.

He was discharged from the hospital as improved fourteen days after admission with a diagnosis of paroxysmal auricular tachycardia with congestive heart failure, congenital heart disease and developmental anomaly of the diaphragm. At discharge there was marked diminution in the size of the right cardiac border, but there was still a circumscribed prominence in the region of the right auricle. The defect of the diaphragm remained the same.

Epidural Granuloma Associated with Osteomyelitis of the Spine. DR. RALPH E. MOLOSHOK.

A 3 year old white boy was admitted to Mount Sinai Hospital on Feb. 11, 1941 with a history of unexplained fever of eight weeks' duration. The family history and the past history were not contributory. There was a history of furunculosis of the buttocks three months before admission. One month after a traumatic blow to the right flank and back there had been an onset of abdominal pain, vomiting and spiking fever (temperature of 103 to 106 F.). He had been admitted to another hospital, where physical examination revealed no cause for the symptoms and the roentgenograms of the chest, the abdomen and the mastoids, as well as an intravenous pyelogram, were normal. Examination of the urine and the cerebrospinal fluid gave negative results. While he was under observation right psoas spasm developed, a diagnosis of perinephric abscess was made and treatment with sulfanilamide and later with sulfathiazole (2-[paraaminobenzenesulfonamido]-thiazole) was instituted. There was gradual subsidence of the temperature to normal, and the symptoms disappeared. After three weeks chemotherapy was stopped, and the patient was discharged. One week later there was a recurrence of fever and the previous symptoms, and in addition there were severe headache and pain in the back. He was readmitted to the same hospital. Examination of the cerebrospinal fluid showed a cell count of 2,550 per cubic millimeter, with 95 per cent polymorphonuclears. The Pandy reaction was positive. No organisms were seen on smear, and the culture remained sterile. Lumbar puncture was not repeated. Sulfanilamide was given for eight days without effect, and because the fever and the other symptoms persisted the patient was transferred to this hospital.

Examination of the patient on admission to this hospital showed a chronically ill, irritable boy lying in bed with his back arched and head retracted. There was resistance to flexion of the neck, and the Kernig and Brudzinski signs were positive. He was alert. The deep reflexes were intact and active. The Babinski sign was positive on the right side. The fundi were normal. There was marked arching of the spine, the paraspinal muscles being held rigidly. No tenderness over the spine was elicited on percussion or palpation, but there was slight psoas spasm bilaterally. Systemic examination gave negative results except that the abdomen showed marked distention and voluntary spasm to palpation, with indefinite tenderness. A rectal examination gave negative results.

The blood count showed moderate leukocytosis; urinalyses gave negative results. The reaction to a Schick test and to Mantoux tests (with up to 1 mg. of old tuberculin) were negative. A lumbar puncture performed shortly after admission yielded slightly cloudy fluid under increased pressure. There was no block. Examination of the spinal fluid showed 550 cells, with 50 per cent poly-

morphonuclears and 50 per cent mononuclears per cubic millimeter and 40 mg. of sugar, 750 mg. of chlorides and 157 mg. of protein per hundred cubic centimeters. A smear of the sediment showed no organisms. A roentgenogram of the spine showed narrowing of the space between the second and third lumbar vertebrae with destruction of the adjacent articular surfaces.

Administration of sulfapyridine (2-[paraaminobenzenesulfonamido]-pyridine) was started soon after admission and was continued for the next four weeks; the level of the drug in the blood was maintained between 5.6 and 10 mg. per hundred cubic centimeters. Because of the meningeal syndrome and the possibility of epidural abscess, exploratory laminectomy was performed on the fourth day in the hospital. The epidural fat from the first to the fourth lumbar vertebrae was replaced by an adherent dark reddish brown membrane composed of granulation tissue. Further exploration revealed no collection of pus. The wound was closed and a body cast applied. After operation the condition showed progressive improvement. The meningeal signs and the Babinski reflex on the right disappeared, the pain in the back and the abdomen ceased and the appetite improved. The patient was discharged after seven weeks in the hospital. He has remained well since that time, and a follow-up roentgen examination of the spine made one week ago revealed condensation of bone about the area which previously showed rarefaction.

Relief of Cardiospasm in the Newborn by Administration of Atropine Sulfate. DR. SIDNEY V. HAAS.

A girl weighing 6 pounds 6 ounces (2,892 Gm.) was born at the Polyclinic Hospital on Jan. 23, 1941 after a normal labor. An older sibling is normal. The patient's symptoms began shortly after birth; there were regurgitation, which later changed to projectile vomiting, scanty stools or none and attacks of cyanosis during the first few days. Changes in diet failed to produce improvement. On the sixth day a transfusion of 70 cc. of citrated blood was given, after which daily hypodermoclysis was used. The infant's lowest weight was 5 pounds 13 ounces (2,637 Gm.). A flat roentgenogram of the chest and abdomen showed nothing remarkable. The stomach was large and both it and the colon were filled with gas. On the seventh day a series of roentgenograms of the gastrointestinal tract taken after the ingestion of a barium sulfate meal revealed dilatation of the esophagus and typical cardiospasm, with the characteristic funnel-shaped dilatation of the esophagus at the cardiac orifice. The stomach was large and well filled, and there was a suggestion of pylorospasm, but the abnormality at the pylorus was not as marked as that at the cardiac orifice. In subsequent films barium was seen distributed throughout the small intestine with the stomach completely empty. A barium sulfate enema showed that the sigmoid and the descending colon were well filled, but none of the barium extended beyond the midcolon area. The impression was gained that no obstruction existed in the colon, the incomplete filling being due to peristalsis. Twelve days later another series of roentgenograms of the gastrointestinal tract was made; there was no sign of spasm and no retention of barium.

Administration of atropine sulfate was begun in small doses on the third day. After the transfusion the patient looked well and vomited less, but until atropine sulfate (1/12 grain [5 mg.] in twenty-four hours) was used the vomiting was not controlled and a satisfactory gain in weight was not attained. She was discharged from the hospital on the forty-second day, weighing 7 pounds 6 ounces. With ingestion of a normal formula and administration of 1/12 grain of atropine sulfate in twenty-four hours progress has been uninterrupted, although there is occasional regurgitation. Her present weight is 10 pounds 10 ounces (4,819 Gm.).

Cardiospasm occurs much more frequently than is generally recognized. The cause is a disturbance of neuromuscular function. Changes have been found in the Auerbach plexus. The diagnosis can be made only by roentgenographic examination. There are many reports on the condition in the literature; it does not occur as frequently in infancy as later. Treatment has been mainly mechanical

or surgical, but occasionally atropine sulfate or some other antispasmodic has been used. Often a single treatment has resulted in permanent cure. In all cases of vomiting of the newborn in which the cause is not obvious a roentgenographic examination should be made to assist in determining the cause.

Duplication of the Ileum with Bleeding Ulcers. DR. CHARLES W. NEUHARDT.

A white boy was entirely well up to the age of 5 months, at which time he began to pass slightly tarry stools. The bleeding by rectum continued for one month, when he was admitted to the hospital because of a massive hemorrhage.

Physical examination revealed a very pale irritable infant whose thighs were flexed on the abdomen and who apparently was having some abdominal pain, although no tenderness, spasm or a mass were observed. A small hemangioma was present on the right thigh. He had severe anemia from loss of blood. The hemoglobin content was 37 per cent, and the red blood cells numbered 3,000,000 per cubic millimeter. The bleeding and clotting times and the platelet count were normal. A series of roentgenograms of the gastrointestinal tract were normal, and a proctoscopic examination gave negative results. Because of these observations a diagnosis of bleeding Meckel's diverticulum or bleeding hemangioma of the small intestine was suggested.

After the infant's condition had been improved by transfusions an exploratory laparotomy was performed. At operation a large ulcer measuring 1¼ inches (3 cm.) in diameter was observed on the free margin of the ileum 3 feet (91 cm.) from the ileocecal valve, a location much farther from the valve than that usual for Meckel's diverticulum. The ulcer was covered with indurated friable omentum and was adherent to the anterior abdominal wall. On further exploration a duplication of the ileum was found. This tubular structure measured 14 inches (36 cm.) in length. Its width and general appearance were similar to those of the ileum, and it was contained completely within the mesentery of the adjoining ileum, the two structures having a common blood supply. It terminated in an opening at the mesenteric margin of the ileum directly opposite the large ulcer previously described, and proximally it ended in a blind pouch. At this operation only simple repair of the ulcer was done, since it was considered advisable to delay resection of the duplication and the adjoining portion of the ileum as long as possible. It was thought that the chances of the patient's surviving such a procedure would increase with age.

After the operation the infant had normal stools for one week, after which they again contained much blood. Frequent transfusions were necessary to prevent exsanguination. Five weeks after the first operation a second operation was performed. At this time 18 inches (46 cm.) of the ileum together with the duplication was resected. A side to side closure of the ileum was made. After a rather stormy course, during which continuous infusion for eight days and frequent blood transfusions were employed, the infant made a complete recovery and is now entirely asymptomatic.

Examination of the surgical specimen revealed that the wall, including the mucosa, of the duplication was similar to that of the ileum. A new ulcer was present in the ileum bordering the opening of the duplication.

Book Reviews

Developmental Diagnosis. By Dr. Arnold Gesell and Dr. Catherine S. Amatruda. Price, $6.50. Pp. 447, with 20 illustrations. New York: Paul B. Hoeber, Inc., 1941.

Dr. Gesell and his co-workers have devoted a great many years to the study of mental growth during the first five years of life. In this volume the authors have presented a comprehensive description of infant development from a clinical and a diagnostic standpoint.

The first chapters deal with methods of making mental examinations. Test materials are described, and the conduct of an examination is explained. Graphs of developmental sequences and careful descriptions of simple tests for determining a "developmental quotient" (the proportion of normal development attained) with drawings of babies to show the normal response to each test make it easy for any physician to secure the test material and to determine accurately whether a baby is developing normally.

The second part of the volume is concerned with defects and deviations of development. Amentia, birth injury, glandular disturbances, convulsive disorders, prematurity and precocity are discussed. Comments on the part environment plays in stimulating mental growth are included. There is also a description of the signs to be observed in neurologic examinations. While much of this material is not new, the developmental approach gives many of the conditions described new meaning.

The remainder of the book is devoted to the diagnosis and handling of mental handicaps. In the appendixes are included points of examination technic, charts suggested for keeping growth records and descriptions of examination equipment.

This book was written for medical students and physicians. The material in the chapters on normal development and diagnosis will be especially useful in everyday practice. The remainder of the book is valuable for reference purposes. It contains much interesting information for the casual or superficial reader and includes far more valuable material for those who wish to go into the details of the fundamental principles of growth and development.

X-Ray Therapy of Chronic Arthritis. By Karl Goldhamer, M.D. Price, $2.00. Pp. 131, with 26 illustrations and 4 tables. Quincy, Ill.: Radiologic Review Publishing Co., 1941.

Dr. Goldhamer draws most enthusiastic conclusions from the results of treatment of 100 patients with all types of arthritis over a period of twenty-one months. Without commenting on the value of the roentgen therapy of arthritis, one may say that the evidence presented is based on the treatment of too small a series of patients over too short a period to warrant the conclusions he has drawn.

The author mentions having treated hundreds of patients with arthritis while in Vienna, but data are not presented. The results of treatment of these patients after many years might add more convincing evidence.

This volume should not make any one an advocate of the roentgen therapy of chronic arthritis.

Studies of the Interpretation of Play: I. Clinical Observation of Play Disruption in Young Children. By Erik Homburger Erikson. Price, none given. Pp. 114, with 4 illustrations. Provincetown, Mass.: Journal Press, 1940.

This monograph describes in detail the theory and practice of psychoanalytic observation of children's play and gives interpretations of the behavior of many children who were under observation in the Yale clinic.

The study is written in rather technical language. It represents a great deal of work and is a valuable piece of research. It illustrates how much knowledge can be gained about children by observing their play.

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President: Dr. E. Lenstrup, Copenhagen.
Secretary: Dr. E. Gjørup, Dronning Louises Børnehospital, Copenhagen.

Nederlandsche Vereeniging voor Kindergeneeskunde

President: Dr. J. H. G. Carstens, Servaasbolwerk 14ª, Utrecht, Holland.
Secretary: Dr. R. P. van de Kasteele, Laan van Poot 340, 's Gravenhage, Holland.
Place: Different places. Time: Three times a year.

Paediatrický Spolok na Slovensku

President: Dr. A. J. C. Chura, Lazaretská 11, Bratislava.
Secretary: Dr. P. Rados, Lazaretská 6, Bratislava.
Place: Pediatric Clinic, University Bratislava. Time: Six times a year.

* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

ROYAL SOCIETY OF MEDICINE, SECTION FOR THE STUDY OF DISEASE IN CHILDREN

President: Dr. E. A. Cockayne, 98 Harley St., London, W. 1, England.
Secretary: Dr. R. Lightwood, 86 Brook St., London, W. 1, England.
Place: 1 Wimpole St., London. Time: Fourth Friday of each month, 4:15 p. m.

PALESTINE JEWISH MEDICAL ASSOCIATION, SECTION OF PHYSICIANS OF CHILDREN'S DISEASES

President: Prof. S. Rosenbaum, 26 Bialikstr., Tel Aviv.
Secretary: Dr. A. Brünn, 9 Maazestre, Tel Aviv.

SOCIEDAD CUBANA DE PEDIATRÍA

President: Dr. Clemente Inclan Costa, Manrique 48, Habana.
Secretary: Dr. Serafin Falcon Lopez, Calle B No. 356, Vedado, Habana.
Place: Cátedra de Clinica Infantil, Hospital Mercedes, Habana. Time: Last Wednesday of every month.

SOCIEDAD MEXICANA DE PEDIATRIA

President: Dr. Fernando López Clares, 12/a. Medellín 191, Mexico City.
Secretary: Dr. Jesus Gómez Pagola, Versalles 64, Mexico City.

SOCIEDAD VENEZOLANA DE PUERICULTURA Y PEDIATRIA

President: Dr. Ernesto Vizcarrondo, Venezuela.
Secretary: Dr. E. Santos Mendoza, Venezuela.

SOCIÉTÉ DE PÉDIATRIE DE PARIS

President: Dr. B. Weill-Hallé, 49 Avenue Raymond Poincaré, Paris, France.
Secretary: Dr. Jean Hallé, 10 bis Rue du Pré aux Clercs, Paris, France.
Place: Hôpital des Enfants Malades, 49 Rue de Sèvres. Time: 4:30 p. m., third Thursday of every month.

URUGUAYAN SOCIETY OF PEDIATRICS

President: Dr. Conrado Pelfort, Av. 18 de Julio 1246, Montevideo.
Secretary: Dr. Héctor Mourigan, Av. 18 de Julio 2175, Montevideo.

NATIONAL

AMERICAN MEDICAL ASSOCIATION, SCIENTIFIC ASSEMBLY, SECTION ON PEDIATRICS

Chairman: Dr. Philip M. Stimson, 25 Claremont Ave., New York.
Secretary: Dr. Hugh L. Dwyer, 315 Alameda Rd., Kansas City, Mo.
Place: Atlantic City. Time: June 8-12, 1942.

AMERICAN ACADEMY OF PEDIATRICS

President: Dr. Edward C. Mitchell, 1075 Madison Ave., Memphis, Tenn.
Secretary: Dr. Clifford G. Grulee, 636 Church St., Evanston, Ill.
Place: Palmer House, Chicago. Time: Nov. 4-7, 1942.
Region I. Place: Bellevue-Stratford Hotel, Philadelphia. Time: April 1-3, 1942.
Region III. Place: Hotel Cleveland, Cleveland. Time: May 14-16, 1942.
Region IV. Place: Ambassador Hotel, Los Angeles. Time: April 23-25, 1942.

AMERICAN HOSPITAL ASSOCIATION, CHILDREN'S HOSPITAL SECTION

Chairman: Dr. D. L. Richardson, 593 Eddy St., Providence, R. I.
Secretary: Dr. Joelle C. Hiebert, 299 Main St., Lewiston, Maine.

American Pediatric Society

President: Dr. Edwards A. Park, Johns Hopkins Hospital, Baltimore, Md.
Secretary-Treasurer: Dr. Hugh McCulloch, 325 N. Euclid Ave., St. Louis.
Place: Skytop Lodge, Skytop, Pa. Time: April 30-May 2, 1942.

Canadian Society for the Study of Diseases of Children

President: Dr. L. M. Lindsay, 815 Medical Arts Bldg., Montreal.
Secretary-Treasurer: Dr. Elizabeth Chant Robertson, Hospital for Sick Children, Toronto.
Place: Brockville, Ontario. Time: June 14, 1941.

Society for Pediatric Research

President: Dr. George M. Guest, Children's Hospital, Cincinnati.
Secretary: Dr. Mitchell I. Rubin, 1740 Bainbridge St., Philadelphia.

SECTIONAL

Intermountain Pediatric Society

President: Dr. Eugene Smith, 385-24th St., Ogden, Utah.
Secretary-Treasurer: Dr. W. C. Cheney, 837 Boston Bldg., Salt Lake City.
Place: Salt Lake City General Hospital. Time: First Thursday of each month, 8 p. m.

New England Pediatric Society

President: Dr. R. Cannon Eley, 319 Longwood Ave., Boston.
Secretary-Treasurer: Dr. James Marvin Baty, 319 Longwood Ave., Boston.
Place: Boston Medical Library. Time: Four meetings a year, occurring from September to May.

North Pacific Pediatric Society

President: Dr. S. G. Henricke, 4215 N. E. Hancock St., Portland, Ore.
Secretary: Dr. J. S. Backstrand, 333 Wyatt Court, Salem, Ore.
Place: Vancouver, B. C. Time: June 21, 1941.

Rocky Mountain Pediatric Society

President: Dr. Donn Barber, 802½–8th Ave., Greeley, Colo.
Secretary: Dr. Kenneth Schmidt, Republic Bldg., Denver.
Place: Children's Hospital, Denver. Time: First Saturday of each month from September to May, inclusive, 7:30 p. m.

Southern Medical Association, Section of Pediatrics

Chairman: Dr. Harvey F. Garrison, 319 E. Capitol St., Jackson, Miss.
Secretary: Dr. Warren W. Quillian, 227 Aragon Ave., Coral Gables, Fla.

STATE

Alabama Pediatric Society

President: Dr. M. V. Adams, 803 Government St., Mobile.
Secretary-Treasurer: Dr. William R. Britton, 4 Catoma St., Montgomery.

Arkansas State Pediatric Association

Chairman: Dr. C. B. Billingsley, 1425 N. 11th St., Fort Smith.
Secretary: Dr. R. E. Weddington, 1425 N. 11th St., Fort Smith.

California State Medical Society, Section on Pediatrics

Chairman: Dr. William Belford, 233 A St., San Diego.
Secretary: Dr. John J. Miller Jr., 2398 Sacramento St., San Francisco.

Florida State Pediatric Society

President: Dr. Warren W. Quillian, 227 Aragon Ave., Coral Gables.
Secretary: Dr. George N. Leonard, 605 Lincoln Rd., Miami Beach.
Place: Concurrent with state association meeting at time of convention.

Georgia Pediatric Society

President: Dr. R. C. McGahee, 1345 Greene St., Augusta.
Secretary-Treasurer: Dr. Don F. Cathcart, 478 Peachtree St. N. E., Atlanta.

Hezekiah Beardsley Pediatric Club of Connecticut

President: Dr. D. C. Darrow, 789 Howard Ave., New Haven.
Secretary: Dr. Joseph L. Hetzel, 103 N. Main St., Waterbury.
Time: Three meetings a year.

Illinois State Medical Society, Section on Pediatrics

Chairman: Dr. Orville Barbour, 331 Fulton St., Peoria.
Secretary: Dr. Craig Butler, 715 Lake St., Oak Park.

Indiana State Pediatric Society

President: Dr. K. T. Knode, 1105 E. Jefferson Blvd., South Bend.
Secretary-Treasurer: Dr. Mathew Winters, 621 Hume Mansur Bldg., Indianapolis.
Time: Two meetings a year.

Iowa Pediatric Society

President: Dr. Morgan J. Foster, 837 Higley Bldg., Cedar Rapids.
Secretary-Treasurer: Dr. Arnold M. Smythe, 406–6th Ave., Des Moines.

Louisiana State Pediatric Society

President: Dr. Julian Graubarth, 3431 Prytania St., New Orleans
Secretary-Treasurer: Dr. W. C. Rivenbark, 3503 Prytania St., New Orleans.

Medical Society of State of New York, Section on Pediatrics

Chairman: Dr. Norman L. Hawkins, 11 Public Sq., Watertown, N. Y.
Secretary: Dr. William J. Orr, 135 Linwood Ave., Buffalo.

Medical Society of the State of Pennsylvania, Pediatric Section

Chairman: Dr. John D. Sturgeon Jr., 22 N. Gallatin Ave., Uniontown.
Secretary: Dr. Elwood W. Stitzel, 403 Central Trust Bldg., Altoona, Pa.
Place: Pittsburgh. Time: Sept. 29-Oct. 2, 1941.

Michigan State Medical Society, Pediatric Section

Chairman: Dr. Harry Towsley, University of Michigan Hospital, Ann Arbor.
Secretary: Dr. Leon DeVel, 110 E. Fulton, Grand Rapids.

Mississippi State Pediatric Society

President: Dr. Harvey F. Garrison Jr., 315 E. Capitol Pl., Jackson.
Secretary: Dr. Guy Verner, 126 N. Congress St., Jackson.

Nebraska Pediatric Society

President: Dr. Andrew G. Dow, 314 Medical Arts Bldg., Omaha.
Secretary-Treasurer: Dr. John M. Thomas, 301 N. 49th St., Omaha.
Place: As announced by Committee. Time: Third Thursday of each month from October to June, inclusive. Dinner at 6 p. m.

New Hampshire Pediatric Society

President: Dr. MacLean J. Gill, 14 N. State St., Concord.
Secretary-Treasurer: Dr. Ursula G. Sanders, 46 Pleasant St., Concord.
Time: Twice yearly.

North Carolina Pediatric Society

President: Dr. Thomas M. Watson, Greenville.
Secretary: Dr. Frederick B. Haar, Greenville.

Oklahoma State Pediatric Society

President: Dr. Ben H. Nicholson, 301 N. W. 12th St., Oklahoma City.
Secretary: Dr. Luvern Hays, 108 W. 6th St., Tulsa.
Place: Oklahoma Club. Time: 6:30 p. m., fourth Friday of each alternate month from September to May, inclusive.

South Carolina Pediatric Society

President: Dr. R. B. Josey, 1517 Hampton Ave., Columbia.
Secretary-Treasurer: Dr. Wilson Ball, South Carolina State Health Dept., Columbia.

Tennessee State Pediatric Society

President: Dr. Kinsey M. Buck, 1193 Madison Ave., Memphis.
Secretary: Dr. Gilbert Eblen, 611 W. Main Ave., Knoxville.

Texas Pediatric Society

President: Dr. P. E. Luecke, 4105 Live Oak St., Dallas.
Secretary-Treasurer: Dr. John Ashby, 3610 Fairmount Ave., Dallas.

Virginia Pediatric Society

President: Dr. John M. Bishop, 511 Medical Arts Bldg., Roanoke.
Secretary: Dr. Edwin A. Harper, 301 Rivermont Ave., Lynchburg.

West Virginia State Medical Society, Section on Pediatrics

President: Dr. Theresa O. Snaith, 450 Center Ave., Weston.
Secretary: Dr. Henrietta L. Marquis, 211 Bair Bldg., Beckley.

LOCAL

Academy of Medicine of Cleveland, Pediatric Section

Chairman: Dr. J. D. Nourse, 10515 Carnegie Ave., Cleveland.
Secretary: Dr. I. B. Silber, 10465 Carnegie Ave., Cleveland.
Place: Cleveland Medical Library Bldg. Time: October, December, February and April.

Academy of Medicine, Toronto, Section of Pediatrics

President: Dr. I. Nelles Silverthorne, 170 St. George St., Toronto, Canada.
Secretary: Dr. G. P. Hamblin, 2333 Bloor St. W., Toronto, Canada.

Bronx Pediatric Society

President: Dr. David Greene, 910 Grand Concourse, New York.
Secretary: Dr. F. E. Chick, 2325 University Ave., New York.
Place: Concourse Plaza Hotel, 161st St. and Grand Concourse. Time: Every second Wednesday of each month, except June, July, August and September.

Brooklyn Academy of Pediatrics

President: Dr. John A. Monfort, 861 Carroll St., Brooklyn.
Secretary: Dr. Walter Coles, 604–2d St., Brooklyn.
Place: Kings County Medical Society Bldg. Time: Fourth Wednesday of each month, except May, June, August and September.

Central New York Pediatric Club

President: Dr. Frank van der Bogert, 111 Union St., Schenectady.
Secretary: Dr. Frank J. Williams, 58 S. Swan St., Albany.
Places: Various cities in New York. Time: Third Tuesday of April and September.

Chicago Pediatric Society

President: Dr. James H. Wallace, 715 Lake St., Oak Park, Ill.
Secretary: Dr. Henry G. Poncher, 1819 W. Polk St., Chicago.
Place: Children's Memorial Hospital, 710 Fullerton Ave. Time: Third Tuesday of each month, October to May, inclusive.

Dallas Pediatric Society

President: Dr. Edgar Loomis, 351 W. Jefferson Ave., Dallas, Texas.
Secretary-Treasurer: Dr. John E. Ashby, 3610 Fairmont Ave., Dallas, Texas.
Place: Bradford Baby Hospital. Time: 1 p. m., second and fourth Saturdays of each month.

Detroit Pediatric Society

President: Dr. Marsh M. Poole, 773 Fisher Bldg., Detroit, Mich.
Secretary: Dr. Donald J. Barnes, 773 Fisher Bldg., Detroit, Mich.
Place: Wayne County Medical Society. Time: 8:30 p. m., first Wednesday of each month from October to June, inclusive.

Fulton County Medical Society, Pediatric Section (Atlanta, Ga.)

Chairman: Dr. Don F. Cathcart, 478 Peachtree St. N. E., Atlanta.
Secretary: Dr. Harry Lange, 478 Peachtree St. N. E., Atlanta.
Place: Academy of Medicine, 38 Prescott St. N. E. Time: Second Thursday of each month from October to April, 8 p. m.

Houston Pediatric Society

President: Dr. Thomas J. Donovan, 3820 Fannin St., Houston, Texas.
Secretary: Dr. Raymond Cohen, 2300 Caroline St., Houston, Texas.
Place: Houston Club. Time: Third Monday of each month.

Kansas City (Missouri) Pediatric Society

President: Dr. John Aull, 1103 Grand Ave., Kansas City.
Secretary: Dr. George Herrman, 1107 Bryant Bldg., Kansas City.
Place: Kansas City General Hospital. Time: On call.

Los Angeles County Medical Association, Pediatric Section

President: Dr. Alonzo Cass, 1908 Wilshire Blvd., Los Angeles.
Secretary-Treasurer: Dr. Gladys Patric Shahovitch, 3936 Roderick Rd., Los Angeles.
Place: Los Angeles County Medical Headquarters, 1925 Wilshire Blvd. Time: Second Monday of February, April, June, October and December.

Medical Society of the County of Kings and the Academy of Medicine of Brooklyn, Pediatric Section

President: Dr. Sydney Nussbaum, 247 Ocean View Ave., Brooklyn.
Secretary: Dr. Harry S. Bikoff, 850 St. Marks Ave., Brooklyn.
Place: 1313 Bedford Ave., Brooklyn. Time: 9:00 p. m., fourth Monday of each month, October to April, inclusive.

Medical Society of the County of Queens, Inc., Section on Pediatrics

Chairman: Dr. A. A. Trivilino, 88-07–150th St., Jamaica, N. Y.
Secretary-Treasurer: Dr. Edith A. Mittell, 144–38th Ave., Flushing, N. Y.
Place: Queens County Medical Bldg., Forest Hills, N. Y. Time: Third Monday of October, January, March and May.

Medical Society of the District of Columbia, Section on Pediatrics

President: Dr. Harry A. Ong, 1801 I St. N. W., Washington, D. C.
Secretary-Treasurer: Dr. William F. Burdick, 5402 Connecticut Ave. N. W., Washington, D. C.
Place: Medical Society Bldg., 1718 M St. N. W. Time: 8 p. m., fourth Thursday of every month.

Memphis Pediatric Society

President: Dr. E. C. Mitchell, 1073 Madison Ave., Memphis, Tenn.
Secretary-Treasurer: Dr. Harry Jacobson, 1193 Madison Ave., Memphis, Tenn.
Place: John Gaston Hospital. Time: Quarterly.

Milwaukee Pediatric Society

President: Dr. R. P. Schowalter, 411 E. Mason St., Milwaukee.
Secretary-Treasurer: Dr. George H. Wegmann, 2650 W. Hopkins St., Milwaukee.
Place: Children's Hospital. Time: Second Wednesday of each alternate month, beginning with February.

New York Academy of Medicine, Section of Pediatrics

Chairman: Dr. Alfred Langmann, 108 E. 68th St., New York.
Secretary: Dr. Dr. Edith M. Lincoln, 660 Park Ave., New York.
Place: New York Academy of Medicine, 2 E. 103d St. Time: Second Thursday of each month from October to May, inclusive, 8:30 p. m.

Northern California Affiliates

President: Dr. Crawford Bost, 490 Post St., San Francisco.
Secretary: Dr. William A. Reilly, 384 Post St., San Francisco.
Time: Second Thursday of September, November, January, March and May.

Northwestern Pediatric Society

President: Dr. Harold Flanagan, 711 Lowry Medical Arts Bldg., St. Paul, Minn.
Secretary-Treasurer: Dr. George B. Logan, Mayo Clinic, Rochester, Minn.
Place: Minneapolis, St. Paul, Duluth and Rochester. Time: January, April, July and October.

Oklahoma City Pediatric Society

President: Dr. J. Byron Snow, 1200 N. Walker St., Oklahoma City.
Secretary: Dr. G. R. Felts, 1200 N. Walker St., Oklahoma City.
Place: Oklahoma Club. Time: Fourth Friday of each alternate month.

Philadelphia Pediatric Society

President: Dr. Philip S. Barba, 222 W. Harvey St., Germantown, Pa.
Secretary: Dr. Aims C. McGuinness, Children's Hospital, 1740 Bainbridge St., Philadelphia.
Place: College of Physicians, 19 S. 22d St. Time: Second Tuesday of each month from October to April, inclusive.

Pittsburgh Pediatric Society

President: Dr. E. L. Piper, 3200–5th Ave., Pittsburgh.
Secretary-Treasurer: Dr. Carl Ruder, 646 Washington Rd., Mount Lebanon, Pittsburgh.
Place: Pittsburgh Academy of Medicine. Time: Second Friday, alternate month from October to June, inclusive.

Richmond Pediatric Society

President: Dr. Louise Fry Galvin, 214 S. Boulevard, Richmond, Va.
Secretary-Treasurer: Dr. Herman W. Farber, 501 E. Franklin St., Richmond, Va.
Place: Richmond Academy of Medicine, 1200 E. Clay St. Time: 8 p. m., third Thursday of each month, except June, July and August.

Rochester Pediatric Society

President: Dr. Herbert Soule, 122 Rutgers St., Rochester, N. Y.
Secretary-Treasurer: Dr. Jerome Glaser, 300 S. Goodman St., Rochester, N. Y.
Place: Rochester Academy of Medicine or arrangement by program committee. Time: Third Friday of each month from October to May.

St. Louis Pediatric Society

President: Dr. Max Deutch, 634 N. Grand Blvd., St. Louis.
Secretary-Treasurer: Dr. Peter G. Danis, 634 N. Grand Blvd., St. Louis.
Place: St. Louis Medical Society Bldg. Time: First Friday of each month from October to June.

Seattle Pediatric Society

President: Dr. Frederick B. Jay, Stimson Bldg., Seattle.
Secretary: Dr. Sherod M. Billington, Medical Dental Bldg., Seattle.
Place: College Club. Time: Third Friday of each month from September to June at 6:30 p. m.

Southwestern Pediatric Society

President: Dr. Norman Nixon, 1136 W. 6th St., Los Angeles.
Secretary: Dr. Donald C. Shelby, 3780 Wilshire Blvd., Los Angeles.
Place: Jonathan Club of Los Angeles. Time: First Wednesday in January, March, May, September and November.

University of Michigan Pediatric and Infectious Disease Society

President: Dr. Campbell Harvey, 35 W. Huron St., Pontiac, Mich.
Secretary: Dr. Harry A. Towsley, University of Michigan, Department of Pediatrics and Communicable Diseases, Ann Arbor, Mich.
Time: Autumn, 1941.

Westchester County Medical Society, Pediatric Section (New York)

President: Dr. John B. Ahouse, 27 Ludlow St., Yonkers, N. Y.
Secretary-Treasurer: Dr. Elvira Ostlund, 64 Highland Rd., Rye.
Place: Grasslands Hospital, Valhalla, N. Y. Time: Third Thursday in October, December, February and April.